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Old Automobile Engines Important Source of Scrap

(Old automobile engines are an important source of scrap, now vitally needed to feed America's war machine. Here cast iron blocks from automobile, tractor, and boat engines are being stripped of steel at one of General Electric's New England plants.)

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MECHANICAL ENGINEERING

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GEORGE A. STETSON, *Editor*

Harrison E. Howe

HARRISON E. HOWE, dean and most distinguished of the editors of "society-owned" technical journals in the engineering field, whose death occurred on December 10, built up *Industrial and Engineering Chemistry* to be one of the most important publications of its kind in the world. In volume and quality of material it is doubtful if any single technical magazine would match it. On a contents page so long that it was obviously crowded one could see, once a month, what Dr. Howe offered his readers. It was wide in variety; it reflected what was timely in the field; and it usually contained a group of articles devoted to the important subject of the day.

Preceding the many pages of solid technical reading matter were the editorials written in Dr. Howe's terse and interesting style, some slightly humorous, some scathingly denunciatory, all well written and timely. Behind them one could see the keen smiling eyes, the alert and interested brain, and feel a vitalizing personality to which chemists and chemical engineers will be forever indebted.

Engineering Manpower

THE 1942 Annual Meeting of The American Society of Mechanical Engineers ended on Friday afternoon, December 4, on a note of high urgency for the future, that of manpower at the college level. The concluding session at which this subject was discussed was of the panel type with Past-President Harvey N. Davis as discussion leader. The needs of industry were presented by three engineers from large plants engaged in war work. The requirements of the Army and Navy were summarized by representatives of each of these arms. The administrative problem was discussed by Edward Charles Elliott, of the War Manpower Commission, and L. Austin Wright, of the Canadian National Selective Service Bureau.

Just before the session ended, President Parker rose to state that the question was as confused as it ever had been, although the solution was implicit in the words which named the act—Selective Service. It took twenty four, not four, years to make an engineer, he said, and it was unfair and unwise to require young engineers to make the choice between volunteering for military service and seeking deferment on occupational grounds.

Undoubtedly, Mr. Parker voiced a majority opinion. The 15,000 young men who are graduated from engineering colleges every year have been subjected to selective procedures from earliest youth. They cannot be replaced; nor can the number of properly qualified men be greatly expanded by "ersatz" processes. To the usual peacetime losses from the young men of the profession the war has already added a tremendous number of withdrawals at a time when the need is greatest. This draining off of engineering manpower should be stopped. Official statements made both in this country and in Great Britain have attested to the fact that quality of military equipment is more important than quantity. Quality is assured by endless hours spent in invention, research, and development, and the bulk of this work is done by young engineers under the supervision of older men. Their work should not be interrupted.

Today we are geared to swamp the enemy with a volume of production beyond anything the world has ever seen. Yet, as General Campbell pointed out at the A.S.M.E. Annual Dinner, the "fluidity of war" demands changes in design and in the number of specific items needed to an extent that requires the complete reconversion of smoothly running production lines so that some other item, more important than the one being produced, may be available. Back of this reconversion are the hours spent by engineers in developing designs and product and in providing tools and methods of manufacture. To maintain this force of engineers and to make needed additions to it are vital to the winning of the war, to say nothing of assuring a sound economy for the times of peace to follow.

As the manpower session ended, Dr. Davis read a resolution, addressed to the President of the United States, a copy of which had been sent to the Hon. Paul V. McNutt, chairman, War Manpower Commission, who was given broad authority to provide "for the most effective mobilization and utilization of the national manpower" in President Roosevelt's Executive Order of December 5. This resolution, which had just been passed by the A.S.M.E. Council, stated the conviction "that the effective prosecution of the war effort demands that an adequate supply of engineers be insured for the armed forces and the war industries through the deferment of certain students in engineering colleges under the following conditions:

"1 Enrollment in a college with a curriculum professionally accredited by the Engineers' Council for Professional Development.

"2 Completion of not less than one term or one semester's work in an accredited professional curriculum in engineering with an average scholastic grade at least equal to that required for graduation."

Following quickly upon the A.S.M.E. Council's action, the Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission met in the Engineering Societies Building on Tuesday, December 8. R. E. Doherty, president, Engineers' Council for Professional Development and president, Carnegie Institute of Technology, is chairman of the Consultative Committee, and Dr. Edward Charles Elliott, president of Purdue University, is chief of the Professional and Technical Division. At the conclusion of the meeting, Dr. Elliott authorized publication of the following recommendation which the committee made to him.

"Recognizing the necessity for a continuing flow of professionally trained men for war industries, especially for urgent development work in improving the quality and production of actual weapons and materials of warfare, this Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission respectfully recommends that the Chairman of the War Manpower Commission immediately take the necessary steps in order to provide temporary deferment from military service for those undergraduates in recognized engineering schools who are subject to Selective Service. Such deferment is necessary pending a more thorough study of the requirements of engineering manpower both by war industries and the Armed Forces.

"This recommendation confirms and re-emphasizes the resolutions made by the recent annual meetings of The American Society of Mechanical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education, and others, looking to the deferment of those young men who are already in engineering training and are maintaining satisfactory academic records. This is not a recommendation for class deferment but is a recognition of a temporary but critical phase of the manpower situation which requires prompt and decisive action to prevent serious crippling of the war program."

The President's Executive Order went a long way toward setting up a sound basis for handling the muddled problem of manpower. What engineers wish to see assured in the exercise of the powers granted by the President is the conservation of the "seed corn" of engineering talent upon which the immediate and future superiority of this nation in engineering, vital to war and peace, depends.

Reduce Accidents

ACCORDING to a recent statement, since Pearl Harbor 85,000 persons have been killed by accidents in the United States and 7,700,000 have been injured. Of the fatal accidents, 42,000 were to workers; and it is said that only one out of eight industrial establishments is fully covered by a safety program. Even assuming it would be possible to institute effective safety programs to guard persons during working hours, there would still remain the hazards of street, home, and recreational pursuits which claim three out of five workers.

Obviously, industrial safety is, in more than one sense, a personal responsibility. No one seriously argues that employers have no responsibilities, but the modern tendency of the public to regard all questions affecting their security and welfare as obligations laid upon others—their government and their employers, for example—and to assume that safety regulations and compensation insurance relieve the individual of the necessity of exercising prudence and caution, is futile nonsense. No one has yet been able to discover all the ways by which a fool may be saved from the consequences of his folly. Safety is still, fundamentally, a personal responsibility.

The toll of accidents which this nation has grown to accept with callous disregard is brought into sharp relief by comparison with recently published figures of civilian casualties in air raids in Great Britain. These casualties, from September, 1939, through September, 1942, totaled 103,379, of which 47,498 represented persons killed. The population of Great Britain, is, of course, much smaller than that of the United States. The dramatic background of war and aerial bombardment has greatly emphasized the wastage and tragedy of human lives resulting from air raids. Because we have stupidly grown accustomed to everyday accidents we have no public concern over their importance comparable to that we feel when the casualty lists of war and bombings are made public. Yet the loss resulting from the 42,000 fatalities among workers since Pearl Harbor must be admitted to be a loss of production capacity which affects our nation, for the most part needlessly, at a time when manpower is being used to the limit in the defense of our way of life.

Industry must assume a large measure of responsibility in the effort to reduce accidents. By intelligent study of hazards to eliminate them as much as possible and by administrative and disciplinary procedures, accidents can be practically abolished. Many plants in the most hazardous industries have gone for years without lost-time accidents because they have made a business of industrial safety. Management and worker have cooperated to this end and are equally proud of fine records. What has led to the spoiling of some of those records lately has been the increase in production, the change in the kinds of work done, and great numbers of new workers and supervisors that have been employed.

Mounting accident wastage at a time when production facilities and manpower have been strained to the limit has led the President to call upon the National Safety Council "to mobilize its nation-wide resources in leading a concerted and intensified campaign against accidents." Accordingly, the Council has organized the War Production Fund to Conserve Manpower, of which William A. Irvin, former U. S. Steel Corporation president, is chairman and Thomas W. Lamont, of J. P. Morgan and Company, is treasurer. A five-million dollar fund is being raised and a national committee of 600 is being formed. Detailed plans for re-energizing the safety movement have been laid. New safety councils in war-production centers, training programs in public schools, trade schools, and engineering colleges, and public education by means of the press and the radio are contemplated.

THE SPIRIT OF A PEOPLE

By JAMES W. PARKER

PRESIDENT, THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THAT this customary address by the President to the members of the Society is, by that same custom, given at the end of his term of office, implies at least an expectation that he will report something of the year's experience. I have visited many of the sections and student branches during the past twelve months although by no means all of them. My acquaintance with members has been considerably increased and I have learned much from them of their observations of other people and of their own attitudes of mind.

The younger men in the student branches are almost all of them affected directly by the war. Most of these engineering students expect shortly to be in the armed forces and they are puzzled to know whether or not they will be given opportunity to make use of their engineering training or will be able to resume that training after the war. A wiser national policy might have obviated that problem and have prevented the almost irreparable waste of trained manpower now threatened. It is, I suppose, one more consequence of the country's mental unpreparedness for which a price must be paid. Because of my belief that there will be great need in the future for men with a thorough training in the fundamentals of technology, I have urged these young men to finish their engineering education whenever circumstances permit; to finish it now if the time is afforded them before entering military service, to come back and finish after the war if need be. I have seen enough of the effects of the last war on young men's careers to give them that advice without hesitation.

The members of the Society themselves are for the most part deeply immersed in the war effort. They are busy in the traditional ways of engineers, their efforts directed toward the effective adaptation of American industry to the manufacture of the materials of war. The techniques of quantity production are applied. Hitherto closely guarded methods are being pooled to that end. We can be everlastingly grateful that without significant exception, responsible men in industry have made common cause with their peacetime competitors. Their engineering staffs are working joyously in this new-found freedom from commercial restraint.

It is necessary for the country's welfare that thinking people exert leadership among their fellows. Public opinion will be formed by the kind of thinking the better informed element of the population is doing. Men must discriminate between truth and fallacy, lest the public mind mistake shadow for substance. Turn over in your minds the political doctrines of the past three decades. In innumerable instances we have plainly allowed professionalized politicians, professionalized teachers, and professionalized publicists to mislead us. We have let our system of primary and secondary education be taken so far out of the hands of the public it serves that certain professional educators seriously question the people's right to be heard. Human incentives to work and progress will be destroyed if some of these teachings are followed to their logical conclusion.

Whose duty is it to combat false doctrines? Whose but the intelligent people now so much engrossed in their private undertakings . . . . . We are committed to the perpetuation of the great ideal of a government which shall reflect in its courses the faith and the aspirations of a new nation. Its people are becoming amalgamated to an extent we do not yet realize by the pressure of great events. They are united now in a common cause. Men are re-examining their beliefs in the light of the realities of the present day. I believe devoutly that the people are returning to the faith of their fathers, inarticulately but surely.

It is not surprising, I suppose, to have found men, nevertheless, thoughtful about the future. The admonition of Past-President Batt in his address to the Society in 1940 that engineers give heed to the changes that will inevitably be upon us after the war has given the impetus to some of this thinking. People are aware of impending social-economic change. They are aware of the coming impact upon the existing order of an acquired internal debt of unimagined proportions, of the seriousness of the job of shifting into peacetime pursuits the army of workers now being trained in the special skills of war production. The productive capacity of industry is being greatly enhanced, but there can be no doubt that the genius that made possible such a conversion of product for war will find means for shifting back to the ordinary uses of a world at peace. The question about which men's minds are puzzled is what kind of a world we shall be living in, what the incentives, what the opportunities. Engineers are wondering whether the product of so vast an industrial machine can find a market or, if not, how the men and women workers now so much in demand can find employment. There is something significant in the fact that members of the engineering profession are turning their thoughts to such matters. When changes come, as come they will, the country should this time have the benefit of the thinking that engineers can contribute.

After going about the country, my strongest impression is that the nation is more homogeneous in thought and purpose than we ourselves have been believing. The variety, even the diversity, of races that have merged themselves to make up the American people has brought not disunion but a marked toughening of the fabric. The racial contributions have been many and they vary from the stamina and innate courage of some elements to the imagination, the high intellect, and the sheer inventiveness of others. They are evidenced by the breadth of scientific research going forward, the capacity for organization, the very adaptability of the workers. Our fathers planted more wisely than we in this later generation have believed, and the fruits of their planting are the manifold accomplishments of a nation formed out of the raw materials of older countries that have come to a new world of infinitely greater freedom and opportunity. One finds proof of it in so many ways. The very names in the Membership List of the

Presidential Address delivered at the Annual Meeting, New York, N. Y., Nov. 30–Dec. 4, 1942, of The American Society of Mechanical Engineers.

Society bear witness to the color and variety of the pattern in which this nation is woven. And with all the singleness of purpose encountered everywhere, one is aware of an absence of rancor, as of an older people who have attained tolerance with their maturity. It is one of the strongest indications one sees of their confidence in the ultimate outcome of the world conflict. It is implicit, for instance, in the action of our Government in removing all civil disabilities from the half million or more of Italian folk rated until a few weeks ago as enemy aliens.

History is a melancholy record of the decay and overthrow of institutions and beliefs built up for generations with long painful effort and devotion. Time and again nations have indomitably faced devastation and still lived. They have survived military defeat and revolution and even the sweeping away of religious concepts and still lived. Whether a people can survive such changes will depend upon the toughness of their spirit.

Our national fabric will be tested even though we shall be spared military defeat. I believe our people now are facing a trial of their faith in self-government, challenged as it has not been challenged for generations. Part of the serious thinking that men are doing is about their own beliefs and the things their sons are growing up to believe. And they are beginning to discover unsuspected instinctive preferences such as determine the character of a people. They are the key to deeply rooted beliefs it has been too much the fashion to flout in these latter days. It is not much wonder that strangers have misunderstood the spirit of the American people. We have ourselves misunderstood it.

Years ago a poet whose authorship some of you will recognize wrote these verses describing the North American as seen through the eyes of his own spirit:

> His easy unswept hearth he lends
> From Labrador to Guadeloupe;
> Till, elbowed out by sloven friends,
> He camps, at sufferance, on the stoop.
>
> Calm-eyed he scoffs at Sword and Crown,
> Or panic-blinded, stabs and slays;
> Blatant he bids the world bow down,
> Or cringing begs a crust of praise;
>
> But, through the shift of mood and mood,
> Mine ancient humour saves him whole—
> The cynic devil in his blood
> That bids him mock his hurrying soul;
>
> That bids him flout the Law he makes,
> That bids him make the Law he flouts,
> Till, dazed by many doubts, he wakes
> The drumming guns that—have no doubts;

That stings some, even yet; but have we held ourselves in much better repute? Have we not been believing prosperity has weakened our fiber? The brave concept of a new country offering sanctuary to the oppressed people of the earth is wellnigh gone. Jacob Riis and his almost religious belief that America is a melting pot of diverse peoples from which a finer civilization will be cast have grown dim in our minds. Our bookshelves have abounded with historical fiction whose authors' purpose seems to have been to prove all we had been taught to revere was but the apocryphal account of legendary figures little resembling the far different and less admirable characters of the actual past.

And as a matter of fact have we followed very closely the paths we laid out for ourselves when we were a younger people? We know now we might have guided better and encouraged our immigrant population. We have suffered injustice and discrimination to mar the record of our industrial growth. In a spirit of sheer selfishness we have unnecessarily limited access by other peoples to our markets, and in admitting this we must admit our own share of responsibility for the troubles of impoverished peoples abroad after the armistice of 1918.

I believe men are beginning now to understand these things better, for I think we have been facing realities since the Japanese attack at Pearl Harbor. We have had to look to the leaders of our Government to reach grave decisions—decisions that may make or mar the future of the country; and I believe we have come to examine those leaders with a more discriminating sense. As one thinks over the lives of the country's statesmen in past crises, the anxieties and doubts of men faced with awful decisions become very vivid. I see now no lack of reverence for Washington and Grant and Lincoln. They stand out of the past, figures of great moral and intellectual stature. I think Will Shakespeare was indulging a playwright's impulse to write claptrap when he said, "The good is oft interred with their bones." We have so many to indulge the public taste for sensationalism that one must see plays and read newspapers with more than ordinary discrimination.

It is necessary for the country's welfare that thinking people exert leadership among their fellows. Public opinion will be formed by the kind of thinking the better informed element of the population is doing. Men must discriminate between truth and fallacy, lest the public mind mistake shadow for substance. Turn over in your minds the political doctrines of the past three decades. In innumerable instances we have plainly allowed professionalized politicians, professionalized teachers, and professionalized publicists to mislead us. We have let our system of primary and secondary education be taken so far out of the hands of the public it serves that certain professional educators seriously question the people's right to be heard. Human incentives to work and progress will be destroyed if some of these teachings are followed to their logical conclusion.

Whose duty is it to combat false doctrines? Whose but the intelligent people now so much engrossed in their private undertakings? "We have left undone those things which we ought to have done" and I feel certain our sins of omission, judging from the results, outweigh a hundred times all the crimes of those Theodore Roosevelt called malefactors of great wealth.

We are committed to the perpetuation of the great ideal of a government which shall reflect in its courses the faith and the aspirations of a new nation. Its people are becoming amalgamated to an extent we do not yet realize by the pressure of great events. They are united now in a common cause. Men are re-examining their beliefs in the light of the realities of the present day. I believe devoutly that the people are returning to the faith of their fathers, inarticulately but surely.

In the 1917 sequel to the verses I quoted earlier in this address, Rudyard Kipling described well the hard road we must travel:

> Not at a little cost,
> Hardly by prayer or tears,
> Shall we recover the road we lost
> In the drugged and doubting years.
>
> But, after the fires and the wrath,
> But, after searching and pain,
> His Mercy opens us a path
> To live with ourselves again.

The times cry out for a leader of the spirit of this people.

ARMS *and the* CHANGING TIDE *of* WAR

MAJOR GENERAL L. H. CAMPBELL, JR.

THE CHIEF OF ORDNANCE SERVICES OF SUPPLY, WAR DEPARTMENT

MAJOR GENERAL L. H. CAMPBELL, JR.

I INDEED feel very much honored to have been invited to address a society such as yours and am very happy at the opportunity afforded me of telling you something of the duties, responsibilities, and performances of the Ordnance Department of the Army, of which I have the honor to be Chief. The first and uppermost thought ever in my mind is my responsibility to the mothers and fathers of my country to see that their sons are equipped with the finest quality of weapons which can be produced by human ingenuity, and that such weapons are supplied in sufficient quantities and at the times and places desired. It is also my responsibility to see that these weapons are maintained in a state of efficiency at all times. This responsibility is indeed a large one, but, owing to the fact that the Ordnance Department has within itself officers of high capabilities, and, furthermore, due to the fact that we have taken our problems to industry with all its great ramifications of science, engineering, production, supply, and maintenance, we in Ordnance feel that our task will be accomplished to the satisfaction of these mothers and fathers of our country.

The Ordnance Department is divided into four great divisions. The first of these is known as the Research and Development Division, headed by Brig. Gen. G. M. Barnes. I have known General Barnes throughout my entire service and have no qualifications in mind when I state that he is, without doubt, the leading ordnance engineer of the world. I know practically all ordnance engineers of the world armies. He has with him a corps of experts of long experience, either in the Ordnance Department or in industry, and each of these men is charged with a specific and particular specialty. It is up to him to marshal information and all assistance which he can to improve the quality of the particular weapons under his purview. To this end General Barnes is affiliated with every research and engineering society of merit within the United States and abroad. We have contacts with the National Research Council, with the National Inventors Council, with various research societies, with various engineering groups such as your own, and with innumerable research and engineering divisions of industrial companies. Our problems at once become their problems, and I here and now acknowledge with deepest gratitude the real debt which the Ordnance Department and the country owes to these gentlemen of these societies.

In addition, we have set up in all of our American Expeditionary Forces throughout the world officers whose whole effort is devoted to getting captured enemy matériel by whatever means may be necessary, cataloging it, and seeing that it is safely returned to our Aberdeen Proving Ground, where we have set up a curator whose duty it is to analyze in every detail this matériel. Such as is good and is in advance, we use. We are and will continue to be our own most severe critics. We have our contacts constantly maintained with the armies and the engineers of our allies and we frequently interchange missions to their countries with them, so that there is a constant flow of military information back and forth. We know of no stone left unturned in our own armies and those of our allies and those of the enemy to obtain information to improve the quality of the weapons which the Ordnance Department designs and produces. We have truly a great organization, which I am confident I can say to you will always assure that we will be in advance of our enemy. The other day in England, General Eisenhower told me that he thought without question that we had the finest weapons and ammunition, tanks and other implements of warfare, with which this army had ever entered a war; and yet I tell you now that if this war lasts but a few years, what we consider now as "top flight" may well be obsolescent at the end of that time. Therefore, we must and will continue in research and development.

The next great division of the Ordnance Department is the Industrial Division, which is headed by Maj. Gen. T. J. Hayes, an officer of long experience in manufacture and production. General Hayes has within his office in Washington branches each devoted to a particular type of work. For instance, we

Basis of an address delivered at the Annual Dinner, Hotel Astor, New York, N. Y., Dec. 2, 1942, of The American Society of Mechanical Engineers.

find a Gun and Carriage Branch, an Ammunition Branch, and so forth. Each is staffed with its own specialists. These branches within the Ordnance Office are relatively small, as we are doing everything possible in Ordnance to decentralize and carry our load to the field, to industry, to the plants where the work is done. For this reason, some twenty years ago we established thirteen Ordnance Districts, which have, over a long period of years, maintained contact and surveyed industrial plants. These offices now are carrying the entire procurement and production duties of the Department. This means that a manufacturer no longer has to come to the bottleneck in Washington, but can go to the nearest District Office. These offices, I may say, are in Boston, New York, Philadelphia, Detroit, Chicago, and San Francisco, and other equally convenient locations to industrial centers, some thirteen in all.

In addition to this decentralization effort, we have a Tank-Automotive Center established in the city of Detroit, where all automotive development, design, manufacture, supply, and maintenance are centered. We feel that Detroit is the automotive center of the world. It has made a huge success in its line and, therefore, we in Ordnance should take advantage of the skill, knowledge, and willingness to assist evidenced by this great industry. I may add that we know that our move to Detroit has been of great success. In addition, various other activities such as loading and explosives plants, maintenance units, procurement of fire control, of gages, and of various other articles of ordnance issue, are placed in other centers—Chicago, Philadelphia, New York, St. Louis—in an effort again to completely meld ordnance and industry.

The next large Division of the Ordnance Department is that of the Field Service, which is headed by Brig. Gen. H. R. Kutz. This service is charged with the supply, issue, and maintenance of all types of ordnance equipment, including ammunition. When we consider the great number of expeditionary forces which we now have and the necessity of supplying our allies, we can readily visualize the immensity of the scope of the work of the Field Service. The distribution factor alone staggers the imagination; and yet this Service, we are told by our allies and by our armies in the field, is meeting their every demand and requirement. The most amazing factor of all this to me is that this small group of Ordnance officers (we had when the war started a total of some 350 men) has been able to rally around itself the reserve officers and civilians, both men and women, who along with them have made this vast task possible as to leadership; and, in turn, industry has been at our side with the greatest of assistance. In these days of total mechanization, an army's supply and maintenance entirely set the pace of an army's advance. They also establish the ability of an army to hold against an attack, and, for this reason, the Maintenance Branch and the Supply Branch of our Field Service are two of our strongest institutions. The reason that the British were recently able to throw Rommel back with such great speed was because, with our assistance and with our automotive weapons, tanks, and self-propelled carriages, they forced him back through superior weapons and superior maintenance. Equally, some months before that time he had driven the British back by reason of possessing exactly those same attributes.

The last grand division of the Ordnance Department is that of Military Training. Obviously, Ordnance cannot supply, it cannot run, depots; it cannot maintain, it cannot issue, ammunition; it cannot recover tanks from the battlefield and do its other myriad duties without trained officers and enlisted men. For that reason we have placed under Brig. Gen. J. S. Hatcher the task of training both officers and men for our Ordnance duties. It is of interest to know we have many thousands of officers and, of course, many more thousands of men, all of whom have been trained by this great training service. On the staff of General Hatcher is a group of outstanding educators of the country, who are constantly at his command for advice and help in our training methods. I wish that you all might visit one of our schools and see how your boys are being trained. To me it was one of the most inspiring days I have ever spent in my life when I went through one of these institutions. A fine lot of boys—a fine lot of instructors—all fired with an ambition to do the best job for their country possible.

I have thus sketched for you in broad outline our organization. Let me now tell you what Ordnance has done to make itself an integral part of the industrial fabric of this country. We have set up machine-tool panels in each of our Ordnance Districts. These have been organized by Mr. N. P. Lloyd of the firm of Lloyd and Arms, machine-tool dealers of Philadelphia. In each of our large districts some 25 patriotic gentlemen of the machine-tool dealers industry have volunteered to serve on the staff of the District Chief. These gentlemen survey plants and assist in every way possible in the correct placing of orders, the saving of machine tools and equipment, and in many other ingenious ways assist in the production program. These gentlemen have done as much as any one agency in subcontracting to small firms within their territory. When the history is written of this war their work will be recognized as one of the outstanding contributions to the war effort. They are men in industry. They remain in industry, but they are available at any time to assist the district chief in the proper placing of his orders and in furthering manufacturing schedules.

Another outstanding achievement, we believe, is that of what we call our Industry Integrating Committees. If we have five or ten or eight firms making the same item, we weld them into one integral company for all practical purposes. We secured the passage of an act by Congress, authorizing this, so as not to be in violation of existing laws. Thus, these various companies engaged in the manufacture of various items of Ordnance equipment set up a central committee which they themselves operate. This committee receives from each of these firms a record of its raw-material stocks; its semifinished and finished components; its tools, jigs, dies, fixtures; its knowledge of its personnel; and thus the various companies in the unit act as one. In other words, they operate exactly as does any large company in this country with many divisions or branches. This, as you can imagine, has been of the greatest value in reaching production in the very minimum of time; in the saving of machine tools and equipment; and in the correct distribution of material. We feel that this has been an outstanding development by the Department and industry during this war.

We have heard a great deal recently about the matter of scheduling. This is a department in which we feel in Ordnance that we have been very much in the lead. We have secured from industry the leading schedulers to be had, and they have set up within our Ordnance structure exactly what you will find in your own companies—exactly the same type of setup. We now have some 150 people in direct scheduling, with 600 collateral people assisting in various angles of scheduling and expediting within our own Ordnance Office. From there we go to districts and individual plants. In other words, we in Ordnance have industry doing our scheduling for us. If industry can't do it, it just can't be done.

And now, in conclusion, if I have left with you the thought that the Ordnance Department recognizes above all that its responsibility to this country lies in getting the highest quality of weapons in the correct quantity at the right places at the right time, and that your boys are the best equipped soldiers in the world today, I have succeeded. Thank you so much.

Constructing the LIRETTE-MOBILE NATURAL-GAS *Transmission* LINE

By W. B. Poor

UNITED GAS PIPE LINE COMPANY, SHREVEPORT, LA.

DURING 1941, United Gas Pipe Line Company of Shreveport, La., constructed a high-pressure natural-gas transmission line, 200 miles in length, from the producing fields of Terrebonne Parish, in southwest Louisiana, to Mobile, Ala. The primary purpose of the line was to supply the increasing demands for natural-gas fuel of heavy industries expanding along the Gulf Coast, from southeast Louisiana to Mobile, and Pensacola, Fla. The construction of this projec was unusual primarily from the standpoints of the terrain traversed and construction methods that were used.

TOPOGRAPHY AND SOIL CONDITIONS

The pipe line roughly parallels the Gulf of Mexico for its entire length of 200 miles; traversing the coastal plains of Alabama, Mississippi, and southeast Louisiana, and the Mississippi River Delta of southwest Louisiana. This latter area is interlaced with canals, bayous, and navigable streams. The water crossings are the Mississippi River, Lake Pontchartrain, 25.5 miles in width, and 65 other streams and canals, of which 17 are classified as navigable. Normal drainage is particularly poor due to the flat, low elevation of the terrain, as emphasized by the fact that the pipe line is laid below sea level at 15 navigable stream crossings and Lake Pontchartrain.

Lake Pontchartrain is not a true lake, but is a landlocked salt-water bay, approximately 40 miles long and 24 miles wide, having a maximum central depth of 16 ft, decreasing uniformly to about 6 ft near the shore. On the east, it communicates with Lake Borgne and Mississippi Sound by way of the Rigolets Pass through which the tide enters. The lake bottom is composed of finely deposited Mississippi River silt except for a narrow rim of sand along a portion of the north shore. Being so shallow, the lake is subject to severe surface disturbances when winds of even mild force are prevailing.

Reclaimed marshes and heavily timbered swamps predominate on the western 50 miles of the line and timbered swamps on the eastern 30 miles. The intermediate portion of the line, with the exception of the lake crossing, traverses a low, poorly drained, sandy, cutover pine prairie.

Aside from the marshes and swamps where the soil consists primarily of humus mixed with fine silt, the soils are alluvial clays mixed with varying amounts of sand—plastic and extremely tenacious when wet.

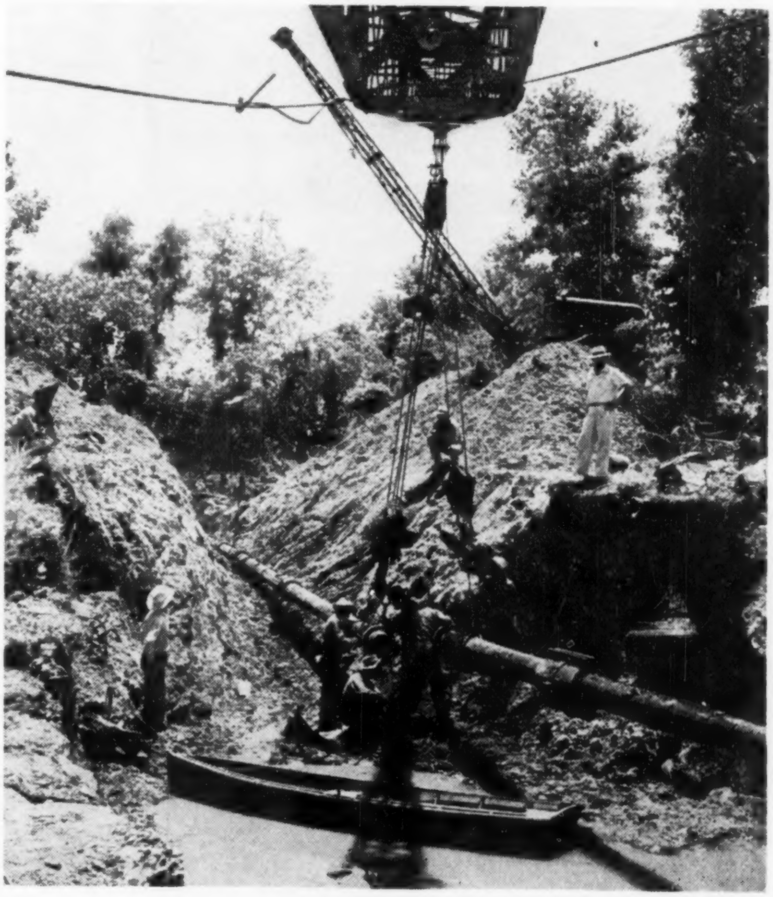
The entire line is laid in soils that are classed as corrosive, the more sandy clays being somewhat less corrosive than the heavy clays and humus.

PROTECTIVE COATINGS

Two types of protective coatings were used in the construction of the line, i.e., a high-melting-point coal-tar enamel and an asphalt mastic.

The coal-tar-enamel coating was used on pipe laid in other than marsh or inundated terrain. The specifications for this coating called for the pipe to be mechanically cleaned and free of rust, dirt, and grease; primed with one coat of coal-tar primer; and yard-coated and wrapped with one $^1/_{16}$-in-thick coat of 200-F-melting-point coal-tar enamel and one wrap of 15-lb coal-tar-saturated asbestos pipe-line felt.

The protection of the pipe line in the brackish waters of Lake Pontchartrain, infested with barnacles and various types of marine borers, and the particularly corrosive soils of the



LANDING 10-IN. LINE, WEST BANK, MISSISSIPPI RIVER

Contributed by the Process Industries Division and presented at the Annual Meeting, New York, N. Y., Nov. 30–Dec. 4, 1942, of The American Society of Mechanical Engineers.

A SHOVING PLATFORM FROM WHICH 28,000 FT OF 16-IN. LINE WAS WELDED AND THEN SHOVED THROUGH SWAMP AND MARSH TO LAKE PONTCHARTRAIN

marsh and swamp lands of the delta presented a serious problem. The experience of other companies under similar conditions was studied, together with the final report of the A.P.I. coating tests. The final decision as to the type of coating to be used in this area was based on two factors—pipe protection and specific gravity of the coating (added weight to overcome the buoyancy of the pipe in water). The protective coating so chosen was an asphalt mastic having a specific gravity of 2.19, applied to the pipe to a thickness of $^5/_8$ in. This coating, known as "Somastic," was an intimate mixture of asphalt, sand, lime dust, and asbestos fiber mechanically applied to the pipe under pressure at fairly high temperature. As the coated pipe left the application head of the coating machine, it was cooled and coated with a whitewash solution that prevented the coating from absorbing excessive heat from the sun while being handled.

DESIGN FEATURES

As constructed, the Lirette-Mobile Project is composed of 77.4 miles of 16-in. line, 31.4 miles of 14-in. line, and 89.4 miles of 12-in. line, together with approximately 40 miles of 8- and 10-in. lateral lines. The main transmission line has a nominal capacity of approximately 80,000,000 cu ft of gas per 24 hr, when operating at a maximum pressure of 1000 psi at Lirette Field and making final delivery at Mobile at 125 psi.

Where accessible locations could be found, main-line sectionalizing valves and blowoffs were located at 6- to 7-mile intervals. Such valves were all flanged-end plug-type valves of an appropriate working pressure.

At the Lirette Field, in order to reduce hydrate formation or freezing in the line, there was constructed a dehydration plant operating on the absorption principle with diethylene-glycol and having a 45 F dew-point depression.

CONSTRUCTION

For purposes of economy and speed of execution, there were embodied in the construction of this project some of the most unusual pipe-line feats ever attempted. Of particular note were the Lake Pontchartrain crossing and the construction methods used in laying through the swamps and marshes.

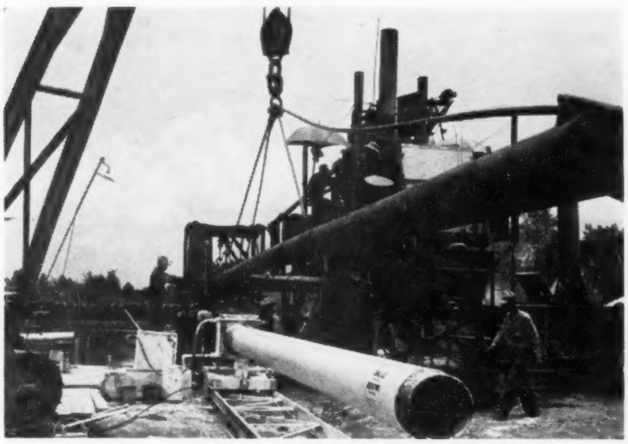
Construction was begun early in July, 1941, on the Mississippi River crossing, some 12 miles above New Orleans, where workmen laid three 10-in. lines, encasing the welded joints on one line with safety sleeves for added protection, in 7 working days. The river, 2800 ft wide, and swift at this point, was approximately 90 ft deep. The line was laid from a working barge equipped with an inclined ramp which lay alongside a material barge and 30-ton derrick barge. Welders, working in pairs, "stovepiped" the 2-joint sections, approximately 100 ft in length, placing four beads at each weld. Other workmen clamped 1000-lb river weights on the pipe at 20-ft intervals. As each weld was completed, the derrick barge picked the pipe off the ramp, the working barge was moved ahead by means of cables attached to anchors on the river bottom, and, with the aid of three lowering-in barges spaced at approximately 200-ft intervals, the pipe was lowered to the river bottom.

While the Mississippi River crossing was under construction, other pipe-line crews were working eastward out of the Lirette Gas Field up along the Godchaux Canal toward the west bank of the Mississippi River. In working along the bank of the canal, welding and shoving operations were accomplished from one location. At this location, a corduroy platform approximately 200 ft long had been prepared in the marsh on the pipe-line right of way. Pipe was delivered to this swamp location by barge. The pipe-line ditch had been dug by handmucking and shooting and was completely filled with water. The 16-in. pipe, having a negative buoyancy of approximately 30 lb per ft in water, was stovepiped from the working platform in 4-joint sections, approximately 200 ft in length. An RD-7 tractor with side boom then picked up the rear end of the pipe section and shoved it ahead in the open ditch. Once the inertia of the pipe was overcome, it was an easy matter for the tractor to shove exceedingly long sections, the greatest difficulty being in stopping the movement of the pipe before the tractor was pulled off the ramp and into the swamp. At this particular location, some 27,000 ft of 16-in. pipe was laid from a single location, the shove eastward being approximately 16,000 ft and the shove westward 11,000 ft. The longest single shove, however, was made between the Airline Highway and Lake Pontchartrain, a distance of 28,082 ft. This entire section of line was made up joint by joint at the Airline Highway and shoved in the same manner as just described to the lake shore.

The crossing of Lake Pontchartrain presented one of the most difficult construction problems encountered on this project. Serious consideration had been given to a land route skirting the western and northern shores of the lake, but the 25 miles across the lake, as opposed to 37 miles by land which would be almost entirely swamp construction, was finally favored. The lake crossing presented not only the problem of the proper use

LAYING 16-IN. LINE NEAR RACELAND, LA.

SHOOTING DITCH ALONG GODCHAUX CANAL

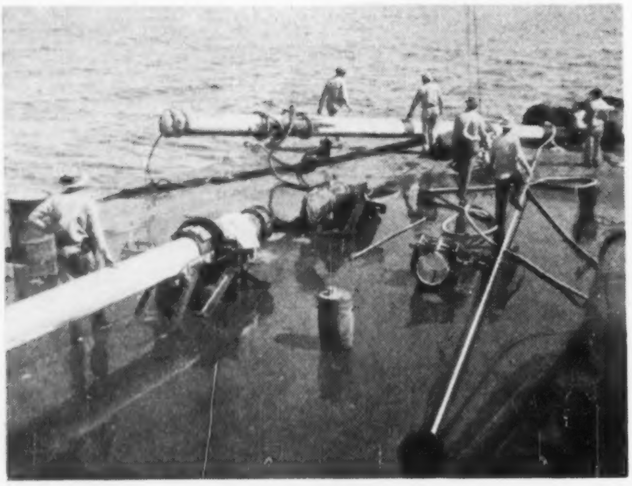


SOMASTIC COATING OPERATIONS ON 16-IN. PIPE

CLEANING AND PRIMING MACHINE ON 16-IN. PIPE

PIPE YARD AND SOMASTIC COATING PLANT AT PARADIS, LA.

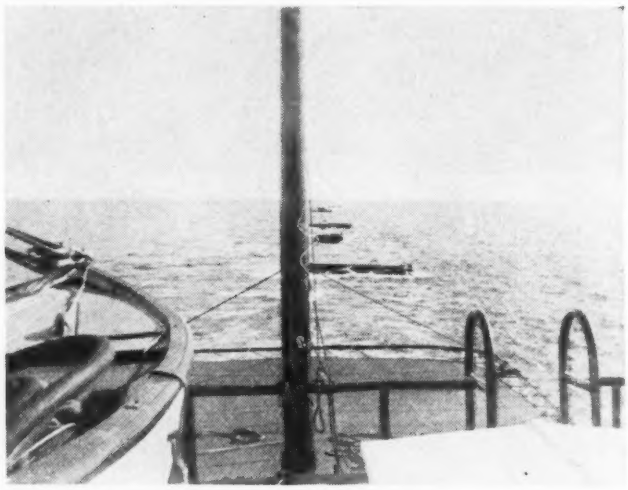
SHOVING PLATFORM ALONG GODCHAUX CANAL



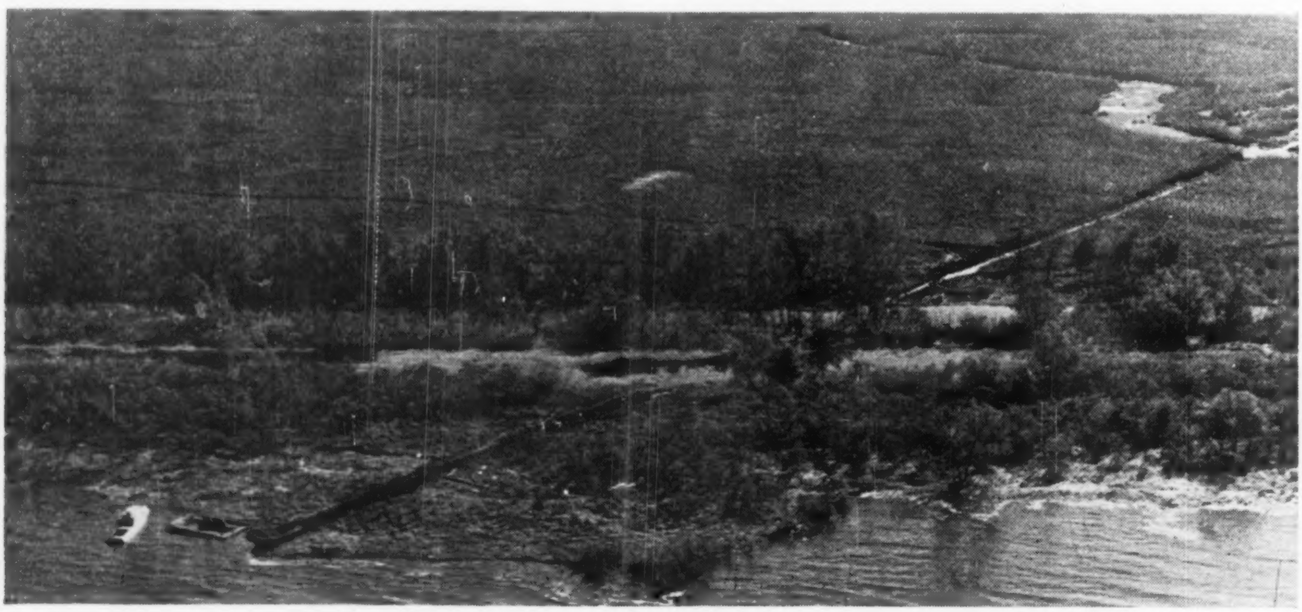
WORK BARGE IN LAKE PONTCHARTRAIN SHOWING SECTION OF PIPE BEING LANDED PREPARATORY TO MAKING TIE-IN WELD

TRACTORS AIDING TUGS IN LAUNCHING 2500-FT TOW OF 14-IN. PIPE, LAKE PONTCHARTRAIN

MAKING TIE-IN WELD ON WORK BARGE IN LAKE PONTCHARTRAIN



TUG ON LAKE PONTCHARTRAIN WITH 2600-FT TOW OF 14-IN. PIPE



AERIAL VIEW OF SOUTH APPROACH TO LAKE PONTCHARTRAIN AND TERMINUS OF 28,000-FT SHOVE

of adequate marine equipment but also a gamble with one of the country's most temperamental bodies of water.

The pipe line enters Lake Pontchartrain on the south shore some 8 miles north of the river crossing and 18 miles west of New Orleans. The land between the Mississippi River and the lake is mainly cypress swamp and open marshland, with the exception of a narrow strip of high ground adjacent to and paralleling the river. The south-shore approach is accessible only by boat. The north-shore approach at Mandeville, in St. Tammany Parish, is however readily accessible by car. The crossing from shore line to shore line was 25.59 miles.

Construction procedure was divided into four main phases: coating, welding, towing, and laying.

All pipe for the crossing was delivered by rail to a coating yard at Mandeville, La. The coating yard, so chosen because of trackage facilities and adequate space for racking both coated and uncoated pipe, was approximately $^1/_2$ mile from the lake front. At this point, the pipe was delivered to an independent contractor for coating with asphalt mastic known as "Somastic."

From the coating yard, the pipe was moved by truck in single-joint sections averaging 43 ft in length to the welding yard. Roll welding in 2-joint sections on racks padded to protect the coating was first attempted. This method of welding was shortly discontinued in favor of position welding, because of the extreme difficulty of rolling such heavy coated pipe, 97 lb per linear ft, without injury to the coating.

WELDING-YARD OPERATIONS

The original welding yard for horizontal fixed-position welding was located directly north of the shore line of the lake on the right of way. After 6 days' operation in this location, the site was flooded and became unusable due to high tides caused by a tropical hurricane of medium intensity. Welding operations were moved to the baseball park at the edge of Mandeville on comparatively high ground. At this location, the majority of the 135,000 ft of 14-in. pipe was welded into 5-joint sections after each joint was coated with Somastic. Welding operations progressed in two shifts. Two welders operated on each joint, and the shielded-arc process of electric-arc welding was used throughout. The ends of the pipe, having a wall thickness of $^1/_2$ in., were machine-beveled at the mill 30 deg for welding, in accordance with A.P.I. pipe-line standards. The field welds were built up of seven beads or runs of welding rod. Runs Nos. 1 and 2 were made with $^5/_{32}$-in. rod, and runs Nos. 3 to 7, inclusive, with $^3/_{16}$-in. rod. The average weld required nine $^5/_{32}$-in. rods and twenty-seven $^3/_{16}$-in. rods. As each field weld was completed, it was immediately coated with a field joint of Somastic coating.

From the welding yard in the baseball park, the 5-joint welded sections, approximately 200 ft of 14-in. pipe, were moved by two D-7 side-boom tractors to a point on the lake front some 800 ft away. At this location on the lake front, a ditch, with its bottom 1 to $1^1/_2$ ft below the water level of the lake, had been dug landward at right angles to the shore line, approximately 400 ft. Here the 5-joint welded sections were bell-hole-welded into a continuous welded string of pipe 2200 to 2400 ft in length, preparatory to towing into the lake for laying and tying-in on the final location. As each 200-ft section of pipe was welded to the tow, the section was progressively moved into the lake by means of the tractors and a tugboat. In order to facilitate towing operations, each end of the 2200- to 2400-ft string of pipe was supported on a pair of steel pontoons, each 4 ft in diam × 22 ft long. The pipe string was made watertight by attaching a "night cap," fabricated from a Dresser coupling having a steel plate welded on one follower ring, to each end. As a final precaution, a 42 × 72-in. steel buoy was attached to each end of the pipe string with some 20 ft of steel cable. These buoys served to mark the location of the pipe string in the lake, in case a sudden storm made it necessary to cut loose the pontoons while towing the pipe to location.

TOWING AND LAYING THE PIPE STRINGS

The mechanics of the towing operations were comparatively simple. Upon completion of a pipe string, preparatory to towing, two Diesel tugs, one of 300 hp and one of 400 hp, were attached in tandem by heavy manila towing cables to the pipe. Since only the ends of the tow were completely floated by pontoons, added power from the beach in the form of the tow tractor and crane was necessary in starting. Once under way, the tows moved into the lake at speeds varying from 3 to 5 mph, depending upon the length of the tow, direction and velocity of the wind, and the condition of the lake surface.

Laying operations were more complicated. The first string of pipe was landed as nearly as possible in the center of the lake. From this point, construction progressed toward the south shore for approximately 5 miles; after which, since the prevailing winds were such that the north shore was comparatively calm, pipe was laid from the center toward the south shore as weather and winds permitted. The laying operations consisted of towing each 2400-ft string to the free end of the line, aligning this string of pipe along the staked survey, and finally welding the two free ends together. The free end of the line as laid was placed in heavy saddle clamps on a steel laying barge by means of the derrick barge operating alongside and over the laying barge. One end of the string of pipe to be attached was towed alongside the laying barge. The derrick barge "boomed out" over the laying barge, picked the end of the pipe tow off the pontoons and placed it in the saddle clamps on the laying barge, where final alignment of the two ends was completed and the tie-in weld made. Upon completion of the weld, the joint was coated with Somastic, and field patches of the same material were used to repair any coating that had been damaged in handling on the barge. Upon completion of this operation, the derrick barges picked the pipe free of the welding barge, a tug moved the barge free of the pipe, and the line was lowered to the lake bottom. The tugs then moved the laying equipment ahead another 2400 ft, placed the free end of the pipe in the saddles on the welding barges preparatory to tying-in the next two, thus completing the normal cycle of laying operations.

Although September is known as a "hurricane month" in southern Louisiana, pipe deliveries could not be made before the last week in August. Surveys were completed during the late spring and early summer and arrangements made for the required governmental permits. By the time pipe was received, the location line had been surveyed across the lake and marked with flags and buoys preparatory to actual construction.

The first pipe was received at Mandeville, on Thursday, August 28, 1941. Coating operations began on Tuesday, September 2, welding operations 3 days later, and on September 6, the first string of pipe was towed into place in the lake. Forty-five days after the first string of pipe was laid, the lake crossing was completed. During this 45-day construction period, three storms, one of "hurricane" force, caused a total of 13 days lost time, days on which all small craft were ordered off the lake by the Coast Guard.

While construction was in progress on the lake crossing, the line was completed from its western terminus, in Terrebonne Parish, to the south shore of Lake Pontchartrain; and other crews were laying line from Mandeville toward Gulfport and Mobile, using conventional pipe-line construction methods. Despite unfavorable weather conditions, the entire project was completed and placed in service early in February, 1942.

PLYWOOD *in* AIRCRAFT CONSTRUCTION

By G. A. ALLWARD

HUGHES AIRCRAFT CO., CULVER CITY, CALIF.

THE inability of our aluminum mills to cope with the demands of our ever-increasing production of aircraft has forced aircraft manufacturers to explore the field for substitute materials. Plastics, in which there have been far-reaching developments in recent years, appeared to offer a solution to this problem, but the all-plastic airplane is still an engineer's dream—yet to be realized. Plastics have been and are being used for many nonstructural parts, but inferior strength-to-weight and creep properties of present-day plastics make them inefficient for use as structural members. Reluctantly, aircraft manufacturers have returned to wood and plywood to fill the breach, and today more and more structural elements hitherto fabricated in metal are being converted to wood. With the exception of the structural research carried on by a few companies who, contrary to popular sentiment, still believed in wood as a structural material for aircraft, practically no research has been conducted in this field for the past fifteen years.

Wood, in fact, was so completely abandoned as a material for aircraft that engineers were trained solely in the art of all-metal construction, and the aircraft woodworker disappeared from the industry. By years of development, involving the expenditure of many millions of dollars in structural research, there is available today a wealth of engineering information to aid engineers in the design of metal structures. Comparable information on wood is extremely meager, and this, coupled with the fact that the vast majority of our engineers are trained exclusively in the technique of all-metal design, has made the conversion task a formidable one, and in many cases, very discouraging. Steps are now being taken to remedy this situation and many laboratories are working under pressure to provide the necessary engineering information, while numerous schools and colleges throughout the country are training students in the art of engineering in wood.

VENEERS

Wood, as is well known, has widely different properties in the various directions relative to the grain. If it had the same strength in all directions, it would be unexcelled for all structural parts where strength per unit weight is desired. The tensile strength along the grain is from three to five times the compressive strength in the same direction, and the tensile strength along the grain may be twenty or more times the tensile strength across the grain. It is not possible, therefore, to proportion a solid piece of wood so as to develop its full strength in all directions. In the construction of plywood, a step is made in obtaining equality of properties in two directions—parallel and perpendicular to the edge of the panel. As a matter of fact, veneers may be proportioned and so disposed as to produce, when glued together, a material having optimum strength in the directions of imposed stresses.

Veneers may be loosely defined as thin wood. They usually vary in thickness from $^1/_{100}$ to $^1/_8$ in., though it is commercially possible to cut it thinner. There are three methods of manufacturing, as follows:

Rotary-cut veneer, as its name implies, is produced in continuous sheets by rotating a log against a knife in a lathe. Hence, rotary-cut veneer is slash-cut and the length along the grain is limited by the length of the veneer lathe. Lengths longer than 100 in. are more or less uncommon. By far the greater portion of all veneer manufactured is made by the rotary-cut process, and there is very little waste in manufacture.

Sliced veneer is produced by slicing sheets from the side of a block or cant with a knife. It may be edge grain or flat grain, and there is practically no waste in its manufacture. The length is limited by the length of the knife which can be operated effectively. The average length of sliced veneer is about ten feet and the maximum about eighteen feet.

Sawed veneer can be produced in almost any length and from any kind of stock. The material produced may be either edge grain or flat grain. There is considerable waste in its manufacture on account of the saw kerf.

SELECTION OF VENEER

In selecting veneer for the fabrication of aircraft plywood, great care must be exercised to be certain that the veneer is sound, clear, free from pitch pockets, shakes, splits, checks, dote or dead streaks, and other injurious defects. Brash pieces and pieces which are abnormally light in weight should be rejected; also pieces containing excessive cross grain. All veneer should be smooth well manufactured stock of uniform thickness.

Attempts to control the quality of veneer by specimen tension tests have, so far, proved abortive. The extreme variability of test values on the same sheet of veneer render the significance of an average value doubtful, and the setting up of a minimum strength value of questionable utility. It is extremely difficult to measure the true tension strength of wood since a very slight angularity of grain will result in shear failure. The same objection, however, does not apply in the determination of compression strength. Reasonable consistency has been obtained over a fairly large number of specimens, and the small variations existing almost exactly followed the density variation. This leads to the conclusion that a density check, together with expert visual inspection, will suffice in the selection of veneer to be used for aircraft purposes. It is also of interest to note that no great difference has been observed between the strength properties of edge-grain and flat-grain veneer of the same species.

GLUES AND GLUING

The principal reason for the abandonment of wood and plywood by the aircraft industry in the early thirties was that neither casein nor blood-albumin glue, the two strongest bond-

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ing agents then known, was completely waterproof or fungus-proof. Under varying climatic conditions, glued joints could not be relied upon to maintain a strong bond, and frequently delamination and complete failure occurred. The advent of the synthetic-resin glues which are absolutely waterproof, fungus-proof, and heat- and cold-resistant, changed the picture entirely and resin-bonded plywood soon emerged to take its place as a dependable structural material.

The synthetic-resin adhesives are based on two types of resin, the thermoplastic and thermosetting. The thermoplastic resins retain the property of softening when heated, while the thermosetting resins, once they are cured, are no longer softened by further heating.

The thermosetting resins which are commercially available as adhesives are of two types; the phenol-formaldehyde and the urea-formaldehyde. As the word thermosetting implies, both of these types of resins harden when subjected to heating. However, by the use of chemical catalysts or hardeners, it is possible to cause resins of both types to harden at low temperatures.

The artificial resins in different forms are thus useful for both hot-press and cold-press gluing. By heating to the neighborhood of 300 F, the resin may be made to harden in a few seconds. When heating to such a temperature is not practical, a hardener may be added to the resin, and curing takes place at a lower temperature, although it may require hours or days to complete. The phenolic type of resin was the first developed and, as an adhesive, shows the well-known advantages of the resin in massive form. Such resins, when completely cured, are highly inert toward moisture and toward all chemical reagents. They are resistant to temperatures which destroy the usefulness of wood and are not attacked either by fungi or bacteria.

Urea-formaldehyde resins have a lesser resistance to water, although a joint made with them may show a strength equal to that of wood, even after several days of immersion in cold water. The successful application of synthetic-resin glues demands rigid control of the temperature and humidity in the glue room, as well as the strict observance of the manufacturer's recommendations regarding the handling of the glue. Veneer for plywood manufacture using hot-press phenol-formaldehyde glue should have a moisture content of from 7 to 10 per cent at the time of gluing. If the veneer is too dry, the glue will not flow, resulting in poor penetration and an inferior bond. On the other hand, a high moisture content at the time of pressing will result in excessive flow, high penetration, and a starved joint. Furthermore, it is important that the application of temperature and pressure be practically simultaneous. If a time lag is unavoidable, then pressure should precede temperature.

Plywood manufactured by the hot-press method has practically zero moisture content when it leaves the press, so conditioning to about 8 per cent moisture content is essential before it may be used in the fabrication of airplane structures. This is usually accomplished by subjecting the panels to high humidity in a humidity-controlled chamber.

Cold-press resin glues usually of the urea-formaldehyde type are commonly used for assembly work where the application of heat is impractical. These glues, when mixed for use, contain a fairly large percentage of water, so it naturally follows that veneers laminated with urea glues increase in moisture content quite substantially. This fact is sometimes overlooked, and laminated parts have been used in fabrication before being seasoned down to a moisture content of from 8 to 10 per cent. The result can be disastrous, for in naturally giving off moisture until equilibrium is reached, the parts shrink to the extent that fittings become loose and glue joints fail spontaneously. As a general rule, best results in gluing and many other operations on wood are only obtainable if all the wooden parts are maintained at the same moisture content. Trouble can be expected when parts with a moisture-content difference of more than 2 or 3 per cent are glued together. Other prerequisites for good bonding are as follows:

1 Well-matched surfaces
2 Surfaces free from dust, oil, varnish, and glaze
3 Strict observance both of maximum and of minimum assembly period (adhere to glue manufacturer's recommendations)
4 Sufficient pressure to bring the surfaces into contact over the whole area of the joint
5 Maintenance of pressure until glue has completely set
6 Maintenance of prescribed temperature until glue has completely set.

UTILITY OF PLYWOOD AS A STRUCTURAL MATERIAL

Having discussed some of the factors entering into the manufacture of aircraft plywood itself, let us now see where plywood can be best employed in the fabrication of an airplane.

First of all, the all-metal airplane has taught us that the scheme of using a shell to provide both structural strength and aerodynamic fairing, previously accomplished by two elements, is economical and sound. We might therefore start by investigating the feasibility of plywood as a material for monocoque and semimonocoque structures. Because of the low specific gravity of plywood, shell thicknesses approximately four to five times the effective shell thickness required in duraluminum structures may be used for comparable weight. Effective shell thickness is understood to mean the total cross-sectional area, skin plus stringers, divided by the circumference of the body. This value is rarely less than 0.05 which would place the comparable plywood thickness at 0.2 to 0.25, depending upon the species of wood used. Since panel buckling is usually the designing factor for stressed-skin structures, let us compare a plywood compression panel to a sheet stringer dural panel. Seldom is it practical to design a dural compression panel to support more than 17,000 psi, and often the design allowable is as low as 15,000 psi. For the same strength-weight ratio, the comparable plywood panel should, therefore, be capable of carrying between 3570 and 4050 psi (using a thickness of 0.21 in.). Tests on birch plywood indicate that for this range of stress, a frame spacing of from 6 to 12 in., depending upon the radius of curvature will be necessary. A prerequisite of mass production is reduction of number of parts to a minimum, so in actual practice the ring or rib spacing would be increased at the expense of allowable stress. This does not necessarily entail a weight sacrifice, however, as the increase in skin weight may well be offset by the weight of the rings or ribs eliminated. As a matter of fact, it may be shown that the over-all strength-weight ratio in compression buckling is not sensitive to ring spacing by the following example:

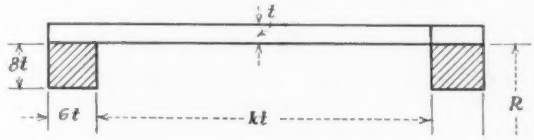

FIG. 1

Assume the following conditions: Cylinder diameter, 50 in., material, birch plywood; design compressive load, 125,000 lb; rings assumed to be $6t$ wide and $8t$ deep (these proportions have been found to be satisfactory in practice).

Let ρ = density of material, lb per cu ft, and other symbols as indicated in Fig. 1. We have

$$\text{approximate weight per unit length} = 2\pi R\rho \left[\frac{t^2(6+k)+48t^2}{t(6+k)}\right]$$

$$= 2\pi R\rho \left[\frac{t(54+k)}{(6+k)}\right]$$

Since $2\pi R\rho$ is constant, the optimum ring spacing will be given by minimum value of $\left[\frac{t(54+1)}{(6+k)}\right]$.

TABLE 1

Allowable stress F_c	Area reqd.	t reqd.	$\frac{R}{t}$	k	$54+k$	$6+k$	$\frac{t(54+k)}{(6+k)}$
4000	31.3	0.199	125.6	33.0	87.0	39.0	0.444
3500	35.7	0.227	110.2	44.2	98.2	50.2	0.444
2000	41.7	0.265	94.4	69.0	123.0	75.0	0.435
2500	50.0	0.319	78.6	142.0	196.0	148.0	4.023

From the calculations presented in Table 1, in which the allowable stresses were taken from test data, it is evident that there is no appreciable change in weight per unit length over a range of ring spacing of 6.6 to 45 in. In addition to the reduction in the number of parts, it is definitely advantageous to use thick skin and few rings from the point of view of torsional stiffness. For the same material and nonbuckling skin, the shear modulus remains constant so the torsional deflection under a given load will vary inversely with thickness. Thus in the foregoing example, the 50-in. cylinder with 45-in. ring spacing and 0.319-in. thickness would be approximately 60 per cent stiffer than the cylinder having 6.6-in. ring spacing and 0.199, in. thickness.

By the use of a forming die and a steam chamber it is possible to form an entire fuselage covering in two half shells. Even the entire upper or lower wing skin can be molded to shape in a single operation. Plywood can be formed into compound curved surfaces almost as easily as into flat sheets. The veneers must be gored; but once the proper templates have been developed, the goring is quickly and easily accomplished. This fact was proved in the manufacture of the fuselage shells for the Clark Model 46 airplane. The fuselage of this airplane was about 20 ft long and 6 ft in diameter, and only eighteen manhours were required to completely fabricate one half shell. The plywood shell elements of a wooden structure are thus well adapted for mass production besides possessing the attributes of an efficient structural material.

Plywood in flat panels can be effectively employed for spar webs, rib webs, gussets, and floor covering. Where high shear strength is required, as in the case of spar webs, the direction of the face grain of the plywood should be at 45 deg to the spanwise center line of the spar. Where compression buckling is critical, however, it is invariably advantageous to run the face grain in the direction of the applied load. The anisotropy of plywood is not necessarily a disadvantage from the practical structural standpoint, since the materials from which plywood is fabricated can be proportioned and so disposed as to most efficiently accommodate the stresses which are to be imposed upon it.

In resistance to fatigue, plywood is far superior to metals, and its energy-absorbing properties are exceedingly good.

Having no hysteresis within the proportional limit which, in tension, is practically the same as the modulus of rupture, there is no creep.

Plywood is not subject to corrosion, which is a distinct advantage over most metals.

The fire resistance of plywood depends, to a large extent, upon the degree of impregnation of the veneers by the resin glue. The normal glue spread (about 20 lb for 1000 sq ft, wet weight) used to produce a satisfactory bond, is sufficient only for a slight degree of impregnation. However, the effect on fire resistance of such penetration is appreciable and a flame of intensity and duration sufficient to melt dural will only penetrate one third of the thickness of plywood of the same weight per square foot, if applied for the same period of time. Laboratory tests have proved that plywood will not continue to burn even after subjection to such a flame for as long as two minutes. This is of but little practical importance, however, since it is usually the fuel fire which does the damage. As far as can be ascertained from isolated tests, the mechanical properties of plywood are not appreciably affected by temperature within the range of +140 F to —70 F.

WEATHERING PROPERTIES OF PLYWOOD

The weathering properties of plywood depend largely upon the effectiveness of the protective coating. The great importance of the protective coating lies in the fact that it slows down the absorption and desorption of moisture and, consequently, prevents the wood from becoming waterlogged on rainy days and very dry under low-humidity conditions. The best protection generally applicable is provided by adequate coverage with good paint, which should meet at least the following requirements:

1 It must be relatively impermeable to moisture.

2 It must be flexible enough to remain intact under the strains and range of temperatures encountered in flight.

3 It must adhere well to the wood.

4 It must resist the action of ultraviolet radiation.

5 It must be proof against gasoline and oils.

6 It must be hard enough to resist the abrasive action of dirt, sand, and hail.

While a great deal of research on plywood finishes has already provided us with paints that substantially meet the foregoing requirements, the problem is still receiving the attention of many foremost research laboratories throughout this country, and we may expect new and improved finishes in the near future.

In converting structural parts from metal to wood, experience has shown that such parts, if properly designed, will weigh less than the metal parts they replace, and in most instances possess superior stiffness properties. The material cost is comparable to that of metal; ranging between 50 and 85 cents per pound, depending upon the species of wood used. There is a distinct lack of information as to the fabrication cost of plywood structures in large quantities, owing to the fact that until quite recently the mass production of such parts had not been attempted. New techniques which will reduce hand labor to a minimum are being rapidly introduced, and it is estimated that in the near future plywood structures will be turned out at a rate and cost which will compare favorably with any other type of construction.

It is historically true that war brings new inventions and new techniques that later contribute to the satisfaction of peace. Resin-bonded plywood is sure to profit by the war, and by the time the war ends, it will unquestionably have made a place for itself as a basic material. Engineers will know its precise limits and capabilities. Thus, instead of being merely a temporary substitute for metal, plywood promises to become a serious competitor in the commercial airplane field following the war.

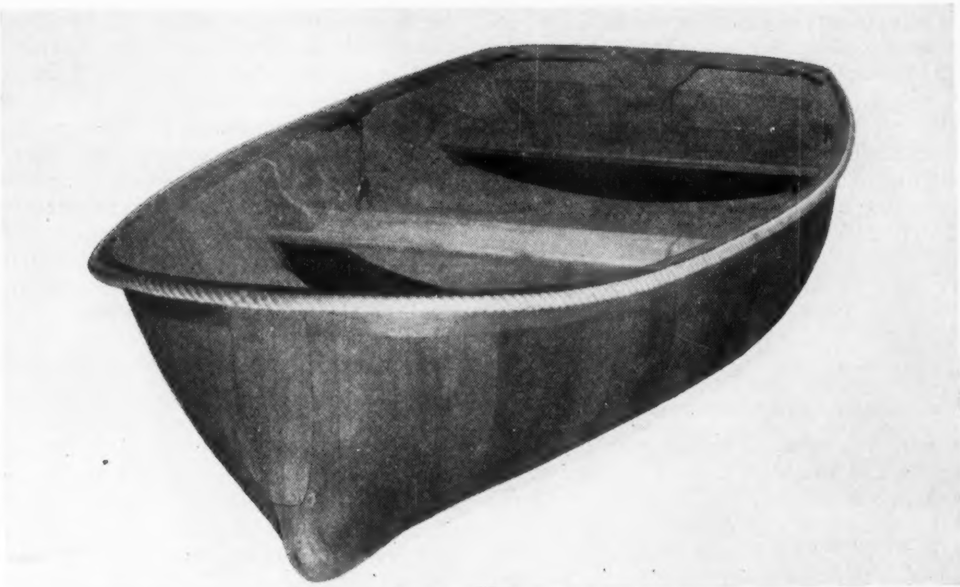

FIG. 1 BOAT HULL PRESENTS PROBLEM OF COMPOUND-CURVED SURFACE

Making PLYWOOD *With* MULTIDIRECTIONAL PRESSURE

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PLYWOOD formed to shape under multidirectional pressure has recently gained wide recognition as a strong lightweight material. It is generally known to woodworkers as molded plywood. Because it has many aircraft applications and because it employs synthetic-resin glue it has also gained wide publicity in the popular press as the plastic aircraft material of the future. The use of the term "plastic" is misleading and the promotional publicity has been extreme to the extent of confusion.

WHAT IS MOLDED PLYWOOD?

The current use of the word "plastic" as a noun to describe loosely that group of synthetic materials molded under heat and pressure implies a material consisting largely of synthetic material and having other material added only in the form of filler or extender. The adjective "plastic" implies the ability to flow in all directions. Molded plywood in no way fills the requirements of either of these definitions since it consists of veneers resin-bonded together in prebent shapes on a mold so that the resulting piece of plywood conforms to the shape of the mold. The synthetic resin acts as a glue only and is a very small percentage of the total, but of yet greater importance, the wood does not flow into shape or become plastic in any way. The veneers are simply bent to shape over a mold and glued together in that bent shape and in such a manner that they cannot become separated without destroying the wood itself.

The processes of molding plywood are very simple in principle. A mold is made, usually of wood, following the shape of the finished product. This may be either a male or a female mold, whichever is found most convenient. Let us assume a small boat hull for illustration. Here a male mold is chosen because it is most easy to work on, and there is no particular requirement for any other type. The mold is the shape and size of the inside of the boat and is made with walls as thin as consistent with the necessary strength for handling and working. The gluing pressure is applied equally in all directions and to both sides of the mold wall, therefore exerting no distorting strains on the mold.

Veneer strips are first coated with liquid resin glue on the surfaces to be glued, and the solvents are dried off at temperatures well below the curing temperature of the resin. The veneers are bent over the mold by hand and held loosely in place by some temporary means, such as wire staples. (A resin film is often used in place of liquid resin.)

Additional layers or plies are laid over the first to form crossbands, cores, and outer faces; their number and the direction of their grain being determined by the requirements of the design. When the assembly is completed and the veneers temporarily fastened to the mold, heat and fluid pressure are simultaneously applied. This is done in a number of ways, the most readily understood of which is the widely publicized

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rubber-bag process. It consists of enclosing the mold with its assembled veneers in a flexible rubber bag. The interior of the bag is vented to the atmosphere to allow all air to escape, and the entire bag and mold are placed in a pressure chamber. Heat and pressure are applied to the outside of the bag, usually in the form of steam admitted to the pressure chamber. The pressure causes the bag to collapse about the veneer-covered mold, the air in the bag escapes through the vent, and the veneers are forced into close conformity with the mold. The pressure, being fluid, acts in a direction normal to the surface and equally at all points. The heat softens the resin glue causing it to flow then to set, forming a permanent bond between the veneers. The product is next removed from the chamber and bag and taken from the mold.

SIMPLE OR COMPOUND SHAPES MAY BE FORMED

Shapes of either simple or compound curvature are produced. It is of course impossible to bend a flat piece of plywood into a compound-curved shape, and to bend plywood to any considerable degree of simple curvature sets up serious stresses. In molded plywood, each of the thin veneers is bent to its final shape and held so until the glue is set Hence, the finished piece is relatively stress-free. Comparing molded plywood to bent plywood of the same shape and thickness, the stress in the molded piece relative to the bent piece is in inverse ratio to the square of the number of plies. There is no appreciable spring-back to molded plywood, and it is generally unnecessary to design molds for overbending.

Because one die or mold only is used, and the fluid pressure conforms perfectly to any shape, it is not necessary to make costly matching male and female dies, and there is no problem in securing sufficient side pressure in deep straight-sided sections as there would be with linear pressure. This flexible pressure which acts equally in all directions also permits the bonding of pieces irregular in shape, such as ribs, stiffeners, bosses, etc., on the outside surface of the product away from the mold. It is possible to bond such members to the opposite side by letting them into recesses in the mold so that their gluing surface is flush with the mold surface. It is possible to vary the thickness of a plywood skin or panel by adding or eliminating a ply of veneer or a lumber insert at the center of the panel or on the surface. It is, therefore, apparent that the hydraulic nature of the gluing pressure permits the bonding together in one operation of veneers, lumber, and other parts to form a structure which could not otherwise be made except possibly by very elaborate and expensive dies.

PROBLEM OF FORMING COMPOUND-CURVED SURFACE

The surface of a boat hull (Fig. 1) contains compound curvature, therefore the veneers as applied to the mold cannot be parallel-edged but must be developed shapes in order to lie as nearly flat on the mold as possible. In most instances it is possible to put all of the curvature on one edge of each piece, which permits the making of large quantities of blanks which are cut off at the proper length then shaped in stacks by one operation. Conical shapes and simple curves in general can of course be made of parallel-edged pieces. The strips used are as wide as the shape and stock permits. The sharper the curvature in compound-curved shapes, the narrower the strips must be, the greater their number, and more labor is required to make and assemble them. Obviously, it is theoretically impossible, no matter how narrow the strips of veneer are cut, to make them conform perfectly to a compound-curved surface and lie naturally in contact with the mold at all points. That the finished product does assume the true compound curve of the mold under the gluing pressure is due to the small amount of natural stretch and compressibility of the wood and not due to any plastic quality imparted by the resin. If the strips are too wide for the curvature, they will fail in tension or compression and split or wrinkle under pressure.

It is also apparent that the radius of the curve to be formed limits the maximum thickness of veneer and, consequently, the number of plies used. Generally speaking, the veneer need only be thin enough to permit its being bent fairly closely to the mold without breaking in the assembly process. Because of the uniform pressure of the gluing process, breakage seldom occurs in the pressure chamber if the molds are properly designed and cause the excess material to be forced or drawn toward the edges of the piece when pressure is applied.

KNOWLEDGE OF WOOD TECHNOLOGY ESSENTIAL

Inasmuch as molded plywood is nothing more than plywood formed in curved shapes, it is desirable that the designer of molded plywood have a fundamental knowledge of wood and plywood behavior. The strength data given for flat plywood may be applied to molded plywood. It is obvious that the grain direction and angle as well as the thickness of various plies have a great effect on rigidity and strength characteristics.

Wood expands more across the grain than parallel to it. The relative stability of plywood compared with lumber under varying moisture conditions is due to the failure of the cross-bands to expand and contract in the same direction as the faces, hence the dimensional change is restrained rather than eliminated. This of course stresses the glue line.

One of the cardinal principles in the design of flat plywood is that the finished piece be of balanced construction, that is, it must be symmetrical in cross section on either side of the core as to number, thickness, and specie of plies; otherwise it will not hold its shape. As moisture is absorbed by the plywood, the expansion must be equal and in the same direction on both sides of the core or neutral axis and consequently balanced, or the piece will be distorted as in the case of a bimetal thermometer.

While the same principles of balanced construction apply to molded plywood as to flat plywood, it appears in practice that it is of less importance in some instances. Pieces of pronounced compound curvature or pieces held in shape by structural members can accommodate a certain amount of unbalanced construction without serious distortion. It is obvious however that changes in moisture content cause stresses in such pieces and unbalanced construction should be avoided wherever possible. Further work appears desirable to determine the full effect of unbalanced construction on the strength and life of molded plywood structures.

It is of material assistance in the assembly of compound-curved surfaces and of simple-curved surfaces of small radii, if the veneers may be laid so that the grain runs at an angle other than 90 deg to the major axis of the curvature. In this way the grain of the veneer bends to a larger radius than the radius of the curve and wider strips may be used.

CALCULATING PRESSURE REQUIRED

While considering veneer thickness and radii of curves, it should be borne in mind that the amount of pressure required to hold the veneer in its bent position is subtracted from the total pressure as it affects the glue line. Best results will be obtained if all radii of curvature are kept as great as possible. Minimum radii for various thicknesses and species of veneers may be determined by the formula[1]

$$R = \frac{ET}{2S}$$

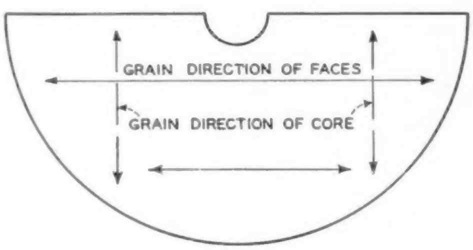
[1] "Values for E and S taken from Bibliography reference (10).

in which

R = minimum radius, in.
E = modulus of elasticity[1] of wood used in a direction at right angles to axis of bend
T = thickness of veneer, in.
S = modulus of rupture[1] of wood used

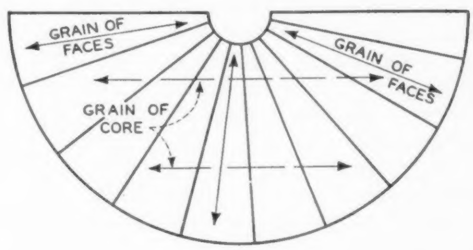
In designing a panel having curvature at any point in its surface it is well that thought be given to the shape the veneers would assume and possible complications in assembly. It is also well, in specifying the grain direction of faces, crossbands, and cores for the desired strength, that study be given to the veneer shapes and sizes that must be developed to cover the surface and satisfy the specification for grain direction. An examination of the cone makes these problems apparent. The cone is shown split open and flattened. Fig. 2A shows that the cone may be made with the face-grain direction at 90 deg to the core at all points. It is also shown that the axis of the curvature of the cone follows the radii of the flattened semicircle, and that the grain of the faces cannot be parallel to the axis at all points. A cone made in this manner is of balanced construction and can be given equal strength in all directions by using a core of proper thickness in relation to face thickness. However, if it is desired to build a cone with greater strength parallel to the axis of curvature, it is logical to use a construction in which the preponderance of grain is parallel to the axis at all points. Wedge-shaped strips of veneer for faces approach this condition, Fig. 2B. However, the core obviously cannot be at 90 deg to these faces at all points. Following the construction shown in Fig. 2B, the grain of the core and face approach the parallel at a point opposite the point where they are at 90 deg. The designed strength is not achieved, the panel is unbalanced, and it will warp out of shape.

Another practical problem encountered in some types of compound curvatures is illustrated in Fig. 3, representing the skin covering of an airfoil such as an airplane stabilizer. While this shape could be molded in one piece, it is apparent that the grain direction of any ply alters radically after rounding the leading edge. In a stressed skin, the designer might well desire to have the grain direction in each ply in the top half parallel to the grain direction in the same ply in the bottom half. This would necessitate making the skin in two halves like a clamshell and joining them together on their center line.



A

FIG. 2A CONE MADE WITH FACE-GRAIN DIRECTION AT 90 DEG TO THE CORE AT ALL POINTS



B

FIG. 2B CONE WITH PREPONDERANCE OF GRAIN PARALLEL TO AXIS OF CURVATURE IS WEAK

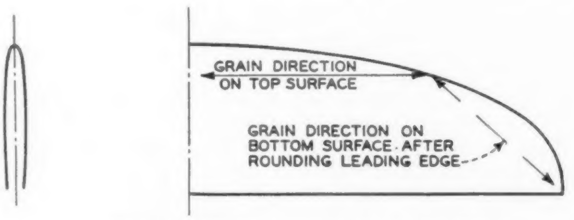


FIG. 3 SKIN COVERING OF AN AIRFOIL

NEW RESINS GIVE FULL-STRENGTH BONDS

Wood has always been an unusually fine structural material with an exceptionally high ratio of strength parallel to the grain to its weight. It has been denied its rightful place in the field of structural materials because its strength across the grain is low, because it was not homogeneous or consistent, and because it was unstable. Plywood largely overcame these difficulties. By cutting wood into thin veneers defects causing inconsistency could be found and eliminated. By crossing the grain of the plies, it became isotropic, and instability was greatly reduced. However, until recently, the adhesives available to bond the veneers together were far inferior to the natural bonding material in the wood, so the glue line became a new source of weakness offsetting the advantages gained. It remained for the present resin adhesives to allow the full realization of plywood possibilities. Now the designer may forget the glue line. A properly made joint, using a correctly selected resin develops 100 per cent of the strength of the wood under all normal conditions of exposure and time.[2] Now, the development of the use of multidirectional pressure, as an inexpensive means of molding this perfected plywood into shapes and structures, has greatly broadened the field of application and caught the imagination of engineers and promoters.

PUBLICITY ON NEW PROCESS MISLEADING

Promotional publicity plays an important part in the acceptance of any new product. In this case however imaginations in some instances seem to have gotten out of control. A haze of mystery has been woven around this beautifully simple material, and we have been promised that it will not only revolutionize aviation but invade every industry from bicycles to bath tubs. So effective has this publicity been that the introduction of the material has met either justified skepticism or unjustified expectations. It is often difficult to convince one that the process and product are no more complicated or elaborate. In order to understand the subject thoroughly it is only necessary to reduce one's thinking to terms of wood and glue.

Molded plywood is not to be confused with high-density plywood, the latter consisting of veneers impregnated with a low-polymer water-soluble resin and compressed while at curing temperature, between metal dies or plates under pressures as high as 1500 to 3000 psi. The density is greatly increased and the characteristics of the material radically altered. If, however, the veneers to be used in the manufacture of molded plywood are impregnated with the same resin before coating with glue and assembling, the resin becomes cured during the bonding process and the wood is rendered much less hygroscopic. The low pressures used in making molded plywood do not give the compression necessary to achieve the characteristics of high-density plywood. However about 75 per cent of the moisture absorption of the wood fibers is eliminated, and an equal amount of expansion and contraction is also eliminated. In this man-

[2] The superior qualities of resin adhesives are thoroughly accepted and generally understood. Practically all of the resin adhesives can and have been used in molded-plywood construction. The subject is too extensive to be included here. The use of phenol-formaldehyde glue is assumed in this discussion, for it is probably the most widely accepted and the only glue which passes the most severe boiling-water tests.

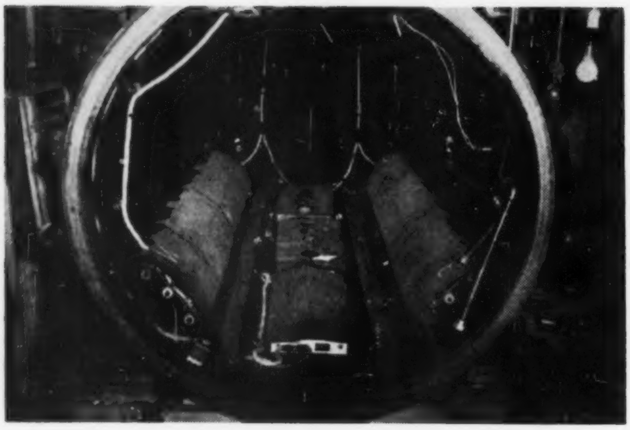


FIG. 4 END VIEW OF AUTOCLAVE WHICH IS USED FOR LOW-PRESSURE MOLDING

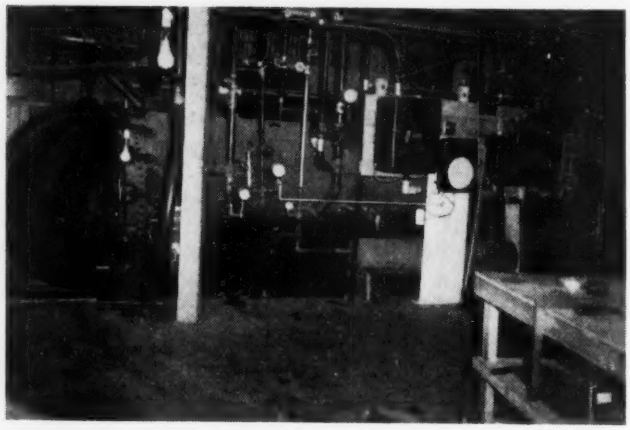


FIG. 5 SIDE VIEW OF SAME AUTOCLAVE AS IN FIG. 4, SHOWING RECORDING INSTRUMENTS

ner molded plywood can be made practically stable. The wood is made slightly harder and more brittle, and the compressive and tensile strength are slightly improved. The wood is also rendered less subject to abrasion, but unfortunately the addition of the resin increases the weight so that the weight-strength ratio is unfavorably affected.

For this same reason the impregnation treatment is of no value to prevent weight increase of molded-plywood parts through moisture absorption from the atmosphere. This development does, however, indicate the future possibility of completely stabilized plywood and suggests the use of high pressures in making molded plywood to achieve the characteristics of high-density plywood. The type of equipment and the practices in use at present could hardly be adapted to the necessary pressures in their present form.

FURTHER DEVELOPMENT OF MOLDING TECHNIQUE NECESSARY

The present technique and equipment used in molded-plywood construction are subject to great improvement and refinement. These no doubt will come quickly as quantity production develops, and with them of course will come lower costs. Molded-plywood costs will always be higher than flat plywood, but not necessarily higher than flat plywood bent to shape. While raw materials are the same, mold costs and assembly operations will always differ and will depend largely upon the shape to be made. The present pressure chamber or autoclave and rubber bag are crude, inefficient, and slow. This is apparent when one considers the vast amount of material making up the autoclave and mold that are heated each cycle in order to cure the very small amount of resin in the glue line. The heat that does reach the glue line must in most cases pass through the heavy rubber bag, which acts as an insulator. The bag is extremely clumsy and easily injured, and it fails quickly under the heat and pressure. In spite of these present shortcomings, molded plywood is distinctly practical from the economic standpoint in countless applications where it is gaining rapid recognition.

Much has been done and is being done to eliminate the inefficiencies. One process has been in successful operation for some time which completely eliminates the rubber bag and all of its shortcomings. High-frequency induction heating can undoubtedly eliminate a great deal of the thermal inefficiency and greatly increase the speed of the cycle. Developments are under way which it is expected will eliminate the autoclave entirely. All of this indicates an interesting and expanding future for molded plywood.

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Progress in RAILWAY MECHANICAL ENGINEERING, 1941-1942

GENERAL CONSIDERATIONS

IN CONSIDERATION of this subject at a time when thoughts of the "war effort" submerge almost every other matter, the mere noting and recording of new designs and new processes which are promising is inadequate, for we have a new epoch upon us. It may be variously characterized but to this compiler it seems that the most important thing now is a word of caution. The response of the railway-transportation system to the requirements of war has been such that there is danger of complacency. It is proper to warn all concerned that the increase of capacity which has been achieved cannot be continued indefinitely. There is a capacity limit somewhere. It will be a great piece of information if sometime in late 1943, perhaps, we shall learn that two billion ton-miles of freight and 100 million passenger-miles per day is the maximum service which skill in management and patriotism and devotion in service can make the 30-billion dollar railway system produce (the figures are about 50 per cent above 1941 results but are not offered as a prophecy!). Based on what 1942 has seen in bulk-oil transportation, these gains are conservative, but few would hazard guesses that the entire traffic could expand as the oil movement has done.

The railways had some "educational" preparation for such a task in the increased traffic that resulted from the Lend-Lease policy and the fast developing Defense Program in 1940 and 1941. Business had been gradually improving since 1932, and efficiency figures obtained in depression times had been maintained with the increased business. After the peak years of 1926–1929 with a little more than a million cars loaded per week, and the 1932 figure of 54 per cent, loadings in 1939 and 1940 were headed upward toward the peak; in 1941 total carloadings reached a new "since 1929" figure of 42,285,000, an average of 813,000 per week with a peak of 923,000 cars in the week of October 18. Early predictions, approximating these figures, foresaw a car shortage of 130,000 at the peak. For 1942 the most frequent estimate came to be a ten per cent increase. Such forecasts necessarily have a considerable relationship to the carriers' program for new equipment, but as the Lend-Lease and Defense programs expanded during the year, it became more evident that the railways were facing trouble in obtaining allocations of sufficient steel and other essentials to care for an adequate equipment program. This resulted in vigorous prosecution of the campaign to reduce the number of unserviceable units, so that at the beginning of 1942 8.6 per cent of the locomotives were unserviceable (about 3500 units) against 14.9 per cent at the beginning of 1941; 3.7 per cent of the freight cars were unserviceable (60,000 units) in place of 6.8 per cent a year earlier. There was NO car shortage. End-of-the-year (1941) surveys of equipment order programs brought orders for the year up to 379 steam locomotives and 595 electric and Diesel-electric units and 113,594 freight cars. There were undelivered at the beginning of the year 730 locomotives of all types and 89,519 freight cars.

The Supply Priorities and Allocations Board on January 2 approved a program and allocated material for 45,000 cars and 926 locomotives. On April 4, the W.P.B. took control of production and delivery of locomotives and cars and on April 8 announced that material would be allotted for the construction of 300 locomotives and 18,000 cars, in addition to the schedules previously approved. This gives a total program for the year of 1226 locomotives and 63,000 cars. The railroads had submitted a program asking for materials for 121,000 cars to the O.D.T. in January. Other operating conditions attained by the beginning of 1941 include the following:

Continuation of the tendency of reduction of the number of locomotives in service at a rate (average since 1916) of about 800 per year. In spite of this fact, aggregate tractive force remained nearly stationary, because of increasing values of tractive force per locomotive.

The progressive decrease in the number of freight cars beginning in 1929 was altered and there was a slight gain in the total number, though this total represents a loss of 26 per cent since 1930. The progressive increase in average car capacity results in the maintenance of almost constant aggregate capacity.

For 1941, revenue carloadings increased 16 per cent and revenue ton-miles 27 per cent, indicating increased car utilization and heavier loading. Increased locomotive utilization was shown by 3 per cent increase in gross ton-miles per train-hour and 9 per cent increase in miles per day for active freight engines. Average freight-car mileage increased 7 per cent; average freight-train speed remained practically constant, while the net load per car was up 4 per cent.

With the change in the last month of 1941 from "millions for defense" to "billions for all-out war" begins an era of railway activitiy, the results of which have been presented in so many forms that little further comment is needed in this place. One measure is in the spectacular increase in tank-car movement of the eastern states: At the first of the year Mr. Pelley, basing his opinion on a modest increase over actual accomplishments of the past, thought the railways might move 200,000 barrels of oil a day from west to east; by October the movement had increased to 800,000 barrels. Warnings of the uselessness of car-loading figures as a traffic measure have been expressed by many experts.

March figures in general compare with 1929 thus:

34 per cent extra ton-freight

25 per cent more passenger miles

24 per cent less employees

This paper constitutes the Annual Report of Committee RR6, Survey, contributed by the Railroad Division and presented at the Annual Meeting, New York, N. Y., Nov. 30–Dec. 4, 1942, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Report compiled and edited by the chairman, E. G. Young, with the co-operation of members of the committee, B. S. Cain, K. F. Nystrom, and Harold C. Wilcox.

The chairman makes general acknowledgment to the railway press of the United States and England, especially to the *Railway Age*, *The Railway Gazette*, and *Locomotive;* to the locomotive builders for furnishing photographs and data; and to the members of the committee for co-operation.

$^1/_3$ less passenger cars and locomotives than in 1929 (same month)
24 per cent fewer freight cars.

The recent trend in gross ton-miles per train-hour:

1922—16,000
1927—22,000
1932—26,000
1937—30,000
1941—35,000

"Thousands of relatively slight improvements introduced by thousands of men" are responsible for such figures, not any revolutionary method or machinery.

What is the place of improved mechanical engineering in such a picture? Constantly improving motive power and cars, conservation, substitution, and reclamation of materials have taken their place with other improvements in the railway's physical plant to make possible the accomplishment of the "heavier trains, longer trains, faster trains, MORE trains" of a recent advertising slogan.

With no desire to minimize the "men and management" side of such accomplishments, the place of "machines and materials" also looms large, in making such things possible.

CARLOADINGS

The matter of using weekly carloadings as a measure of railway traffic has become increasingly misleading. The two factors which bring about this result are obviously heavier loading of cars and longer hauls. With two thirds of 1942 gone, carloadings to date were almost 10 per cent below those of the peak traffic year, 1929, while revenue tonnage began a spectacular climb beginning in February and, at the reporting date, with June as the last full month, had reached 22 per cent above the corresponding 1929 figure, while revenue ton-miles was 48 per cent higher.

SCRAP

For many years the matter of railway scrap has been important in mechanical-department thinking. The emphasis was on what could be saved to avoid purchase of new material, or could be reclaimed to the same end. In this year the scrap drive has assumed a new form of importance with a new end in view involving reprocessing into the form of bundles which might be conveniently delivered in the direction and at the velocity desired. Railroads, as well as all other industries, are being combed thoroughly for scrap materials to a degree which makes previous scrap campaigns look rather casual. Many railways have put scrap gathering into the hands of special committees which have, by personal contacts, broadcast and "sold" the program to employee rank and file and to supervisory forces alike. Inspection at times goes as far as the opening of individual lockers, which have commonly yielded large results in little-used or useless tools. Trash dumps have also been profitably searched, and there is, for example, a single dump which in 1941 had yielded 36 carloads of scrap and on the present year's intensive search produced 377 tons of ferrous scrap and 300 lb of brass. Fills have been "mined" by power shovels and returns in "pay dirt" have been profitable. Examination of section tool houses, abandoned buildings, and boarding outfit tool cars have also been profitable to the scrap hunters. The tendency to use railroad land as a dumping ground has also yielded much iron and some other scrap, including many worn-out tires. The general procedure has been to concentrate scrap in central scrap yards under the direction of stores forces; in these central scrap yards the material is sorted for disposition to reclamation, re-use, and steel-mill destinations.

ACCIDENTS

The number of train accidents in 1941 showed an increase, and a further increase in the current year; as the Safety Section circular of October 1 says, the railroads' reputation, for train-handling safety is being jeopardized. The number of these accidents due to man-failures is painfully apparent. Anyone who follows the current accident reports with any degree of attention is impressed by the number caused by inadequate flagging, excess speed in yard, and other causes which can be placed under the general classification of "neglect of caution signals." The last hundred I.C.C. accident investigations, as reported in the *Gazette* for September 26, and hence covering the period from May, 1941, to July 1, 1942, show the following results:

21 caused by flagging failures
14 by excessive speed
11 by failure to observe signal indications
11 involved train orders, incorrect, undelivered, or not properly read and compared by trainmen
3 violations of yard rules
10 miscellaneous man-failures.

Thus 70 out of 100 train accidents were chargeable to man-failure, and to these must be added a normal number of locomotive accidents, including boiler explosions chargeable to low water—again man-failure. Conditions of inexperienced employees and inadequate supervision and training cannot be avoided under present transportation manpower conditions, but enginemen, the most common offenders, are rarely "inexperienced" in any acceptable meaning of the word, and freight conductors are too often busy doing clerical work in their cabooses rather than conducting, which is a situation for the management and not the mechanical engineer to remedy.

During the year June 30, 1941, to June 30, 1942, there were 153 accidents in locomotive operation resulting in 15 deaths and 182 injuries. These figures represent 7, 20, and 20 per cent reduction, respectively, from figures of the preceding year. The number of locomotives inspected and found defective was 9 per cent against 8 per cent in the previous year.

Of the 153 accidents, 43 were caused by the failure of the boiler or of some appurtenance, which accidents caused three fourths of the deaths and 30 per cent of the injuries. All of the boiler accidents of the current year were caused by low water resulting in overheated crown sheets. Investigation of two serious explosions showed serious neglect of the condition of boiler feeding devices. Serious neglect was also evident in some cases with regard to the maintenance of water-level indicating devices—gage cocks, glasses, and connections. Altogether, 63 different classifications of defects found are presented among the 9570 locomotives ordered out of service. Total defects found were 37,691. Numbers in these classes ranged from one engine ordered out of service for defective train-control equipment to 7215 cases of inspections and tests not made as required. The second most numerous class was springs and spring-rigging defects.

LOCOMOTIVES

The first locomotives of the 2-6-6-6 wheel arrangement are represented by item 1 of Table 1 and by Fig. 1. The owning road names them the "Allegheny" type. The primary purpose of these engines is to haul tonnage coal trains but as they are designed with 60-mph speed in mind their field of usefulness is almost unlimited. An average driving-axle load of 78,500 lb commands as much attention as their six-wheel trailing truck and 10,000 sq ft of heating surface.

In the Union Pacific *Big Boy* we have another new wheel arrangement following naturally upon previous construction

TABLE 1 CURRENT LOCOMOTIVES

Item no.	Type	Builder	Owner	Service	Cylinders No.	Cylinders Diam of stroke, in.	Working pressure	Driving wheels	Weight in 1000's	Tender Type	Tender Coal, tons	Tender Water, gallons	Tender Weight with $^2/_3$ load	Heating surface and superheating surface	Grate area, sq ft	Notes
1	2666	Lima	C.&O.	F	4	$22^1/_2 \times 33$	260	67	724.5	14-W	25	25 M	426.0	10,426	135	New type
2	4884	A.L.Co.	U.P.	F	4	$23^3/_4 \times 32$	300	68	762.0	14-W	28	24 M	342.2	8,356	150	New type
3	464	B.L.W.	C.&O.	P	2	25×30	255	78	439.5	12-W	30	21 M	317.0	6,043	90	
4	4664	A.L.Co.	U.P.	F-P	4	21×32	280	69	627.0	14-W	28	25 M	348.5	6,957	132	
5	482	A.L.Co., Lima	N.Y.C.	F-P	2	$25^1/_2 \times 30$	250	69	399.0	12-W	43	15.5 M	304.1	6,758	75	
6	484	Co. shops	Mo.P.	F-P	2	28×30	250	75	446.0	12-W	20	17.25 M	...	6,790	75	Conversion
7	4444	B.L.W.	Penna.	P	4	$19^3/_4 \times 26$	300	80	497.0	16-W	41	19.5 M	354.0	5,889	92	Nonarticulated
8	484	Lima	C.&O.	P	2	$27^1/_2 \times 30$	255	72	494.6	12-W	25	22 M	310.0	7,799	100	
9	484	B.L.W.	A.T.&S.F.	P	2	28×32	300	80	503.5	16-W	7000 Gal	25 M	375.0	7,677	108	
10	4882	B.L.W.	S.P.	F-P	4	24×32	250	$63^1/_2$	658.0	12-W	6100 Gal	22.0	317.0	9,086	139	Cab-ahead type
11	060	Sou.	Sou. (Eng.)	Mx.	2	19×26	230	61	1140	6-W	5.5	4300	85.3	1,432	22	
12	462	A.&B., India	A.&B.	P	2	16×24	180	57	113.0	8-W	7.5	3600	84.0	1,432	15	India std. design, narrow gage
13	282	Lima	Br. War D.	Mx.	..	21×28	200	60	201.0	8-W	....	....	121.0	2,789	47	For Middle East
14	280	Lima	U.S.A.	Mx.	..	21×26	210	50	180.0	8-W	10	6500	100.0	2,404	43	

and a new engine on the mythical "largest locomotive in the world" pedestal. Note item 2 of Table 1 and Fig. 2. No dimension in particular can be picked out as "impressive" for every figure in the table is impressive: Four $23^3/_4 \times 32$-in. cylinders and 68-in. drivers combined with 300 psi pressure meet this test.

Item 3 and Fig. 3 represent new passenger power for the C.&O. which is definitely a new design. Production of these engines included an unusual amount of welding and other efforts to economize strategic materials.

Item 4 and Fig. 4 picture the current "crop" of Union Pacific 4-6-6-4's. It has long been axiomatic that repeat orders are the best evidence of the effectiveness of a design, so the 4-6-6-4 must be thoroughly effective.

Item 5 of Table 1 and Fig. 5 represent the most recent order of 4-8-2 locomotives for the New York Central. This line first adopted this type in 1916, and the present orders from both Lima and A.L.Co. represent a long history of improvement and development with little variation from the basic design.

Among the many conversions and rebuilds which have been part of the railway program of making the most of existing motive power, the Missouri Pacific program warrants special note. Plain-bearing Lima-built 2-8-4's of 1930 have been rebuilt and by lengthening the frames have been fitted with 75-in. in place of 63-in. driving wheels. The general dimensions are recorded in Table 1, item 6. Roller bearings are fitted to all axles of engine and tender. Monthly miles on these engines are double the performance of the original.

Item 7 of the locomotive table and Fig. 6 show one of two passenger engines built for the Pennsylvania, in many respects following the engine exhibited at the New York Fair two years ago. This is a lighter engine and has four-wheel leading and trailing trucks in place of six-wheel trucks, higher boiler pressure, smaller cylinders, and is equipped with poppet valves. One of the engines adds a 13,000-lb booster to its 65,000-lb tractive-force rating. A sixteen-wheel tender with 41 tons of coal capacity, which when fully loaded weighs 89 per cent as much as the engine, and a full equipment of roller bearings are arresting characteristics.

The C.&O. 4-8-4's of item 8 and Fig. 7 are near duplications of existing engines with a weight near the maximum for rigid construction.

The Santa Fe 4-8-4's, item 9 and Fig. 8, are the second order for substantially similar locomotives. Eight of the new engines have plain bearing rods and tandem main rods; the other two are equipped with Timken bearings. Light rolled pistons are installed on all, with multibearing crosshead sand aluminum gibs. All wheels on engine and tender are provided with roller bearings.

Item 10 of Table 1 and Fig. 9 call attention to the current lot of Southern Pacific cab-ahead simple articulated engines. Forty in this order plus another order already placed will bring the total number of these units in service to 175.

A locomotive of the present year which from its most unconventional appearance has attracted considerable notice is the Q1 class of the Southern Railway (of England). See Fig. 10. Examination of the set of dimensions given in Table 1, item 11, indicates nothing unconventional, nor does the diagram-of Fig. 11. The engine has inside cylinders of normal 19×26-in. size employing the usual link-motion steam distribution. The characteristic appearance results from boiler clothing plates made as flat and square as possible, combined with entire absence of running boards, splashers, and the like, and the use of elaborately cored disk wheels.

Item 13 of Table 1 represents an order of light 2-8-2 locomotives build by the Lima Locomotive Co. for war service in the Middle East. In view of the fact that the design was new, the

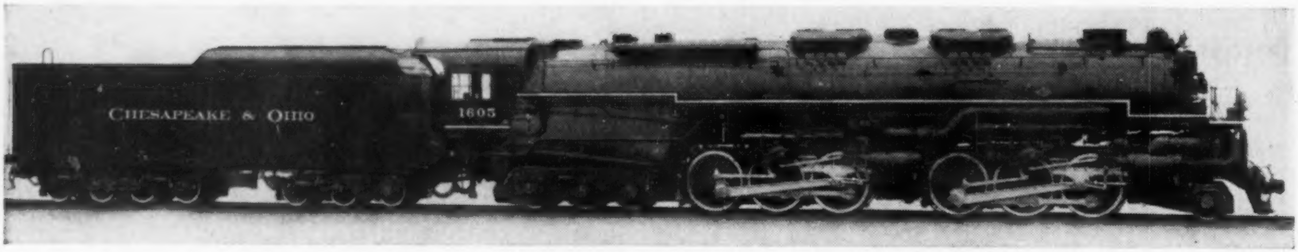

FIG. 1 CHESAPEAKE & OHIO "ALLEGHENY TYPE" 2-6-6-6 (LIMA)

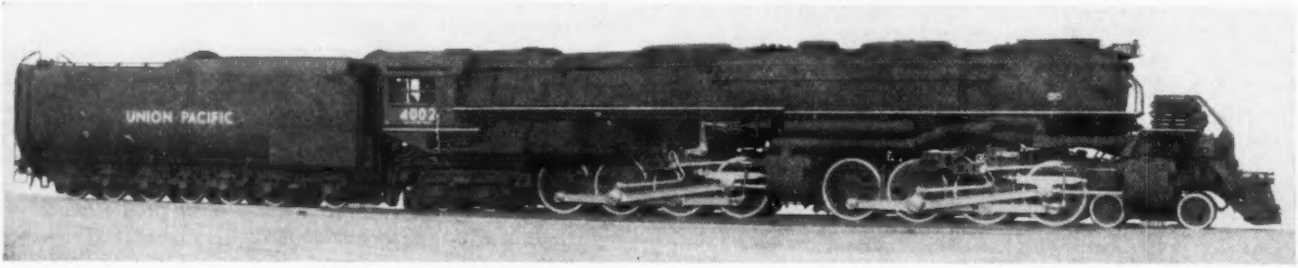

FIG. 2 THE UNION PACIFIC *Big Boy* 4-8-8-4 (A.L.CO.)

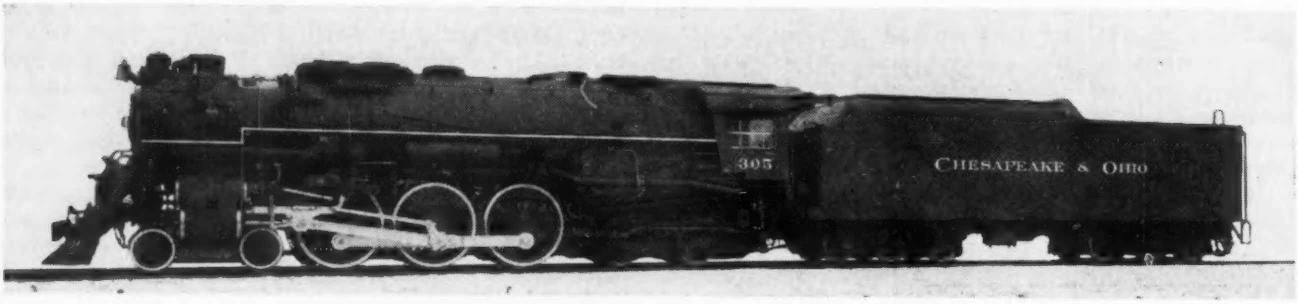

FIG. 3 CHESAPEAKE & OHIO 4-6-4 (B.L.W.)

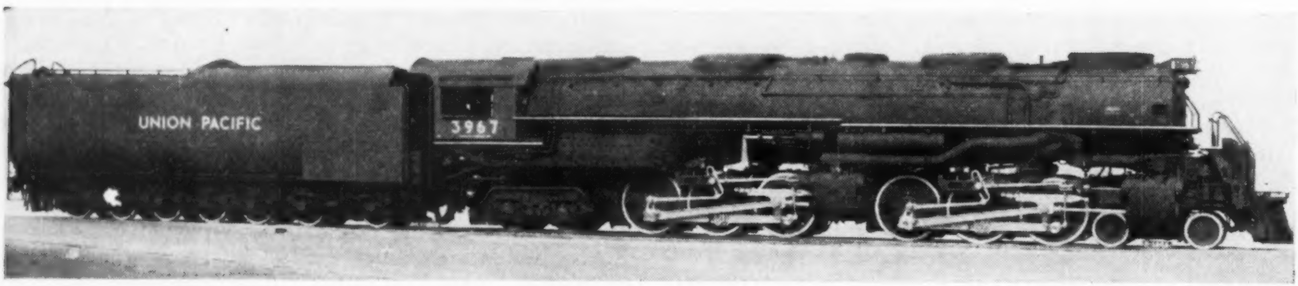

FIG. 4 UNION PACIFIC 4-6-6-4 (A.L.CO.)

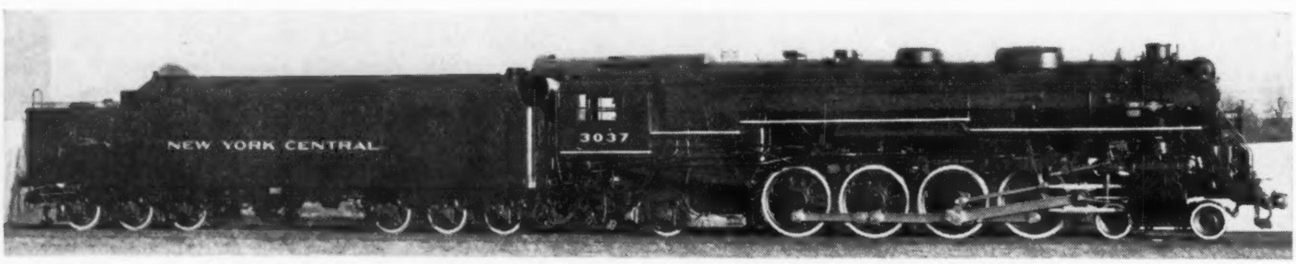

FIG. 5 NEW YORK CENTRAL 4-8-2 (A.L.CO. AND LIMA)

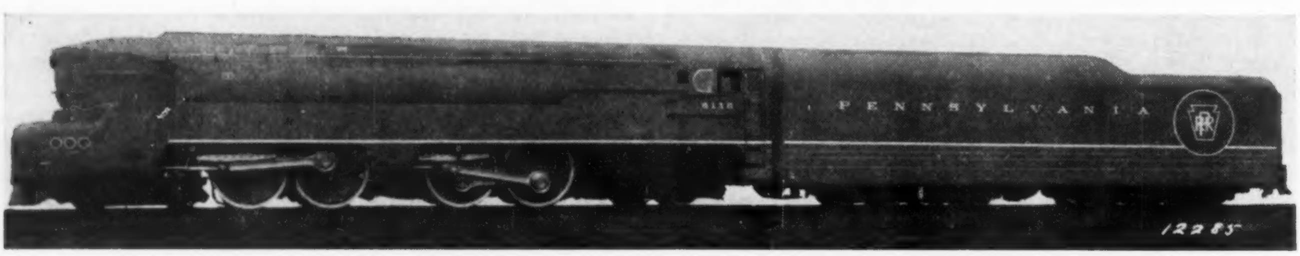

FIG. 6 PENNSYLVANIA R.R. 4-4-4-4 (B.L.W.)

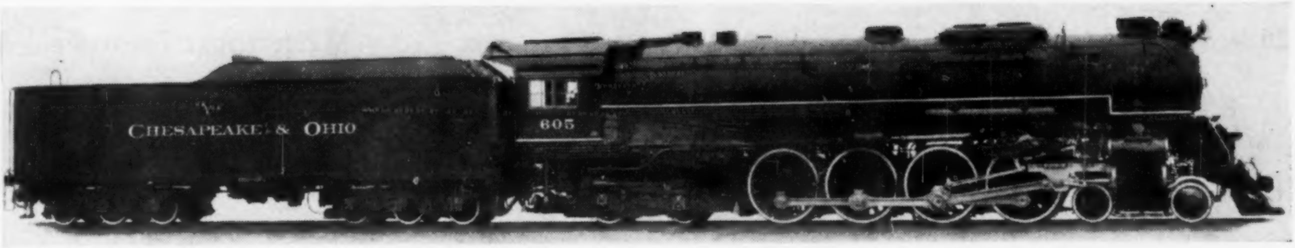

FIG. 7 CHESAPEAKE & OHIO 4-8-4 (LIMA)

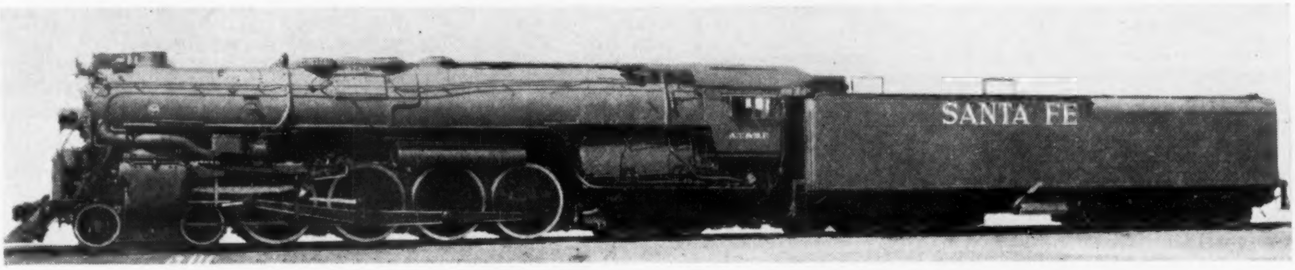

FIG. 8 A.T. & S.F. 4-8-4 (B.L.W.)

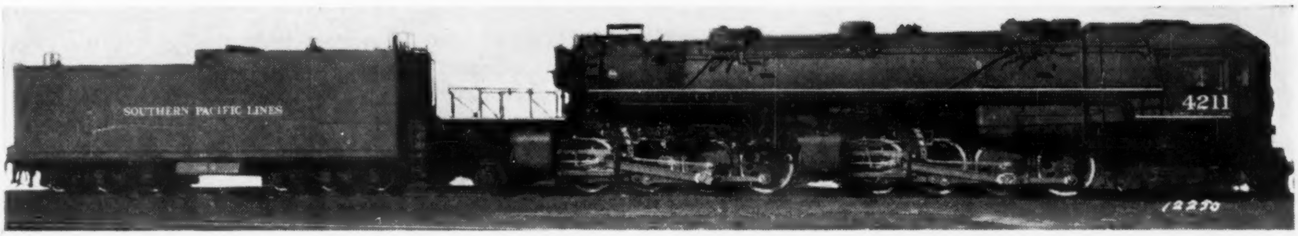

FIG. 9 SOUTHERN PACIFIC 4-8-8-2 (B.L.W.)

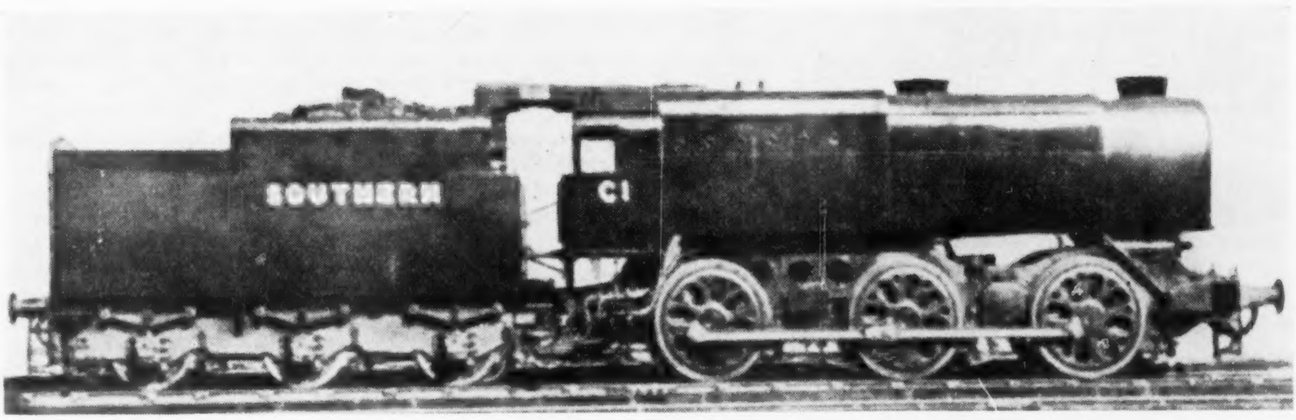

FIG. 10 SOUTHERN RY. (ENGLAND) (COMPANY SHOPS)

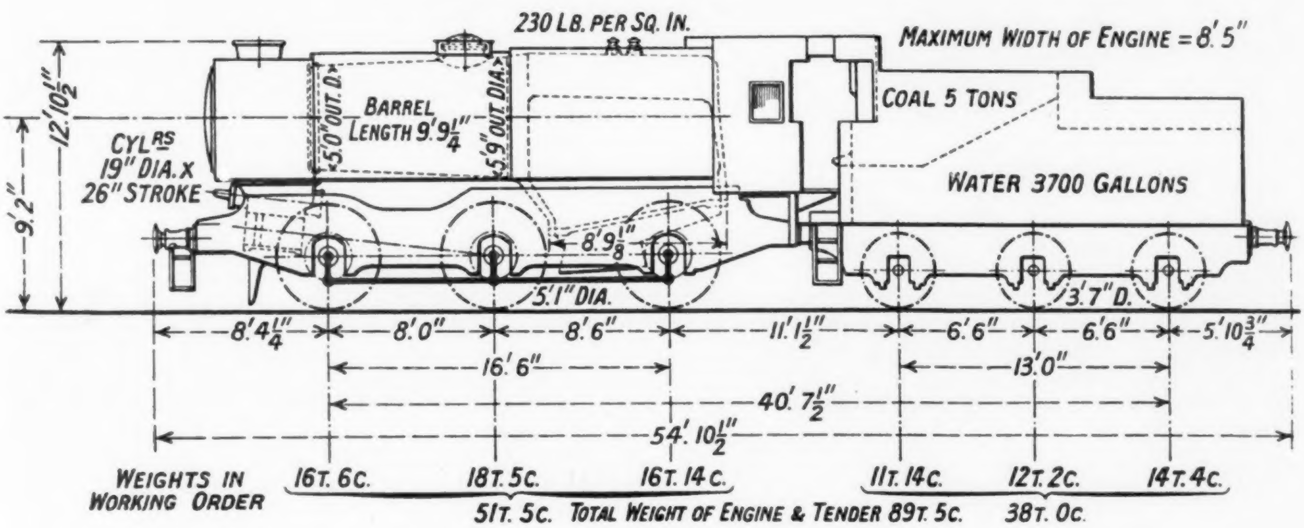

FIG. 11 SOUTHERN RY. OF ENGLAND 0-6-0 DIAGRAM

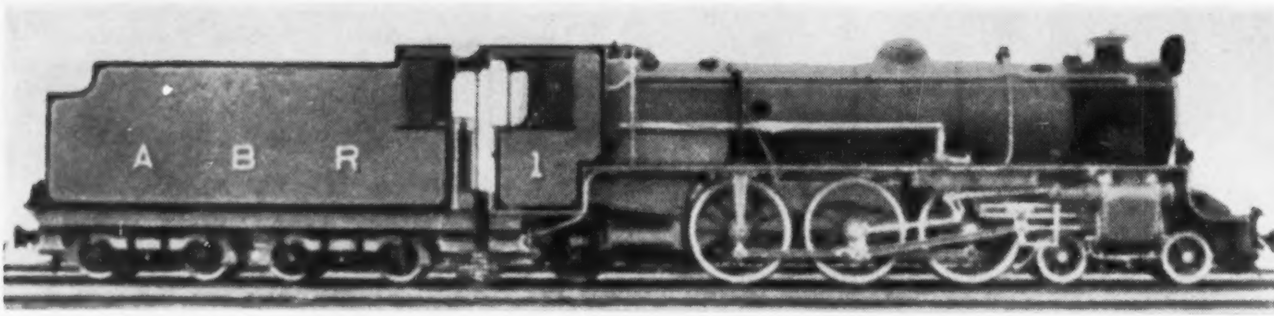

FIG. 12 ASSAM BENGAL RY. 4-6-2 (NARROW GAGE) (COMPANY SHOPS)

completion of the first engine three months from the date of the order is noteworthy. The design is simple and rugged and special consideration has been given to easy maintenance. The use of injectors designed to handle feedwater at 132 F is of interest.

One of the finest appearing "small bundles" of recent years is the railway-shop-built 4-6-2 for the meter-gage Assam Bengal Railway. See Fig. 12 and item 12 of Table 1.

Rebuilding and conversion jobs commonly take the form of change from a less usual to a more usual arrangement when wheel arrangement change is involved. A useful conversion which reverses this procedure has been made by the Illinois Central. A group of heavy switchers and transfer engines, at the same time suitable for road service, were produced when boilers from retired 2-8-2 engines were combined with machinery from former 2-10-2's released when their boilers were taken for heavy 4-8-2's—Mikado boilers plus 2-10-2 machinery equals 2-10-0 engines with 30×32-cylinders and $61^{1}/_{2}$-in. drivers. In another conversion there is no change of type, but the rejuvenation of an Atlantic type to haul local freight warrants attention. Here, $63^{1}/_{2}$-in. drivers replace the original 81-in. wheels to produce a tractive force of 24,000 lb.

THE EXPERIMENTAL WELDED BOILER

This series of reports has frequently referred to the progressive history of the all-welded boiler experimentally installed on a Delaware and Hudson locomotive in 1937. This was built by a system of all down-hand welding and installed with the permission of the Bureau of Locomotive Inspection. During the first year of operation at quarterly inspection the jacket and lagging were completely removed; during the second year it was inspected semiannually, and since then annually; and the final annual inspection previous to the completion of the five-year test was in August, 1942. The boiler is apparently in the same condition as when put into service. Welding is an attractive possibility in future construction; the construction process eliminates two major causes of boiler-maintenance cost since it leaves no place for the minute leaks which are apparently responsible for caustic embrittlement and, by removal of the necessity for calking, reduces the tendency toward heavy local stress concentration.

Permission has been granted by the Inspection Bureau for the construction of another welded boiler. The A.S.M.E. Boiler Code Committee has proposed a number of amendments to the locomotive-boiler section, which have been published for criticism and comment. If these are approved, they will become part of the section 3, Specifications. The most interesting of these is the increase of the factor of safety from 4.5 to 5. It is not to be hoped that the change to welded construction will have any general effect on the number of boiler accidents, since this is unrelated to crown sheets burning as a result of low water.

LOCOMOTIVE THERMAL IMPROVEMENTS

A sharp criticism of railway management in general was published under the heading "Chemical Engineering for Transport: Scientific Methods for Railways," in a March, 1942, number of the British magazine *Chemistry and Industry*. It drew from the *Railway Gazette* a pointed rejoinder, of which a summary may be useful. The original declared that the steam locomotive, in capacity up to 3000 hp and speeds up to 75 mph, was a grotesque contrivance consisting of a low- or medium-pressure hand-fired boiler working at not over 325 psi and low superheat steam at, say, 650 F with a noncondensing reciprocating steam engine developing an over-all thermal efficiency of 6–8 per cent and wasting, presumably in England, 185,000,000 tons of coal per year. The use of higher pressure and superheat in a condensing turbine is advocated, combined with latest designs of high-pressure forced-circulation generators, of which several designs are specified by name. Turbine locomotives with superpressure generators have been operated with efficiencies representing 14–17 per cent, representing about one third as much fuel for an equal amount of work. It is contended that railway management has refused to adopt such methods as they have other primary advances, such as . . . (and there follows a list of primary advances against which American railway managements have NOT fought). The article is based on the idea that the relatively small self-contained locomotive power plant should be built on the efficient lines practicable for the stationary power plant, and in particular it criticizes the lack, on the part of the British railways, of a locomotive testing plant. In conclusion, the article calls attention to the fact that the outlook of railway management does not change at the same, or any comparable, rate of speed as engineering progress.

To paraphrase the *Gazette's* rejoinder: There may be industries in which engineering practice is governed purely by the principles of chemical-engineering technology, but the railway industry is governed by economics. The railway must obtain its transportation power in terms of the maximum power and tractive force per unit cost, with a degree of reliability that admits of no experimenting in service. The history of the locomotive-testing laboratories is in itself a material refutation of the changes made, not forgetting the fact that a national laboratory project in England is held up by the war effort, and that mobile testing laboratories accomplishing the same purpose have been developed and built. The history of the various types of advanced locomotives and boilers is not of sufficient encouragement for much further experiment or expense on any developed thus far. The German Government's announced policy of several years ago to abandon development efforts on other than improvement of standard conventional types is an evidence of this. The criticism as a whole is not entirely factual, insufficiently informed of the outcome of experiment along the very lines for which it acts, and, owing to its failure to appreciate

such basic problems as weight, boiler capacity, and dimensional limitations, is noncompetent.

A paper by R. M. Osterman before the Pacific Railway Club offers an important study of advanced design possibilities. The author briefly mentions numerous inventions and plans designed to improve locomotive efficiency and states reasons for their failing to materialize as practical motive-power devices and quotes the well-known phrase of W. A. Stanier, who explained that "preoccupation with reliability" was largely responsible for the lack of interest of British railways as means for improving thermal performance. Mr. Osterman calls attention to the recognized advantages of the Diesel engine and also to the fact that higher thermal efficiency is the least of these, since a four-times-greater efficiency combined with three-times-greater cost per heat unit of fuel leaves only a narrow margin of thermal gain in dollars, and expresses the belief that improved steam-locomotive construction can overcome this margin. This improvement must come about through supplying steam at higher pressures and expanding it to a near-atmospheric exhaust pressure at the time of maximum power demand. The limit of the present locomotive type boiler being not far above 300 psi pressure, substantially higher pressures must be generated in water-tube boilers which require a high degree of feedwater purification. This in turn demands a condensing arrangement, giving the accessory advantage of eliminating most water stops and much boiler washing and repair. Drastic departures from the conventional engine arrangement are necessary if the flexibility of the Diesel-electric is to be approached. Hence, a primary object in new design will be to provide a means of carrying as large a proportion of the total weight as is possible on the driving wheels and the transmission of power through gearing in order to obtain uniform torque and adhesion. The paper presents a sketch of a proposed duplex condensing high-pressure locomotive, in which separate high- and low-pressure boilers are installed with power generated by a steam turbine compounded with a high-speed rotary-displacement engine, which drives the wheels through a main drive shaft concentric with the center pin of each four-axle truck. Air-cooled condensers are located on the roof. A middle swivel truck is located under the fuel storage tank. The turbines work under 2000 psi pressure at 850 F; in the rotary engines the steam is expanded from 150 psi down to 2 psi pressures. The characteristic curve of the resulting locomotive should show a constantly rising horsepower output to a speed beyond 110 mph while not rising at low speeds as fast as the curve for the Diesel-electric type. Quoting the author verbatim, "I fully believe when the steam-locomotive designer proves that he can build steam plants of small enough weight, able to provide the large excess of power able to provide acceleration at high speed, he can afford to dispense with excessively large starting efforts, with excessive locomotive lengths, the electric drive, and the multiple-unit control system. Such a locomotive should be built within a weight of 100 lb per drawbar horsepower including adequate fuel storage and water reserve, and one general design should be suitable for sizes up to 6000 hp." It is fair to note that Mr. Osterman is looking well into the future since some of the devices he pictures are not as yet in a stage of development for commercial use.

ELECTRIC AND DIESEL-ELECTRIC LOCOMOTIVES

The New York, New Haven, & Hartford R.R. has placed five electric locomotives of new design in service in 1942. Principal data are as follows:

Wheel arrangement	2-C + C-2 (or 4-6 + 6-4)
Total weight, lb	500,000
Weight on driving axles, lb	360,000
Weight per driver, lb	60,000
Length over couplers, ft	80
Rigid wheel base, ft, in	13, 8
Wheel diam, driving, in	57
Wheel diam, guiding, in	36
Tractive effort at 25% adhesion, lb	90,000
Continuous horsepower, 4860 at	65 Mph
or 4780 at	39 Mph
Maximum horsepower, 9000 at	38 Mph (90,000 lb T.E.)
Max speed, mph	65
Power supply	11,000 volts 25 cycles, ac

The locomotives are remarkable for their high tractive effort at comparatively high speed in freight service. They are designed for easy future conversion to high-speed passenger and freight locomotives by change of gear ratio, addition of a train heating boiler and removing ballast, although it is expected that they will be used in emergency passenger service with the present 65-mph gear ratio. See Fig. 13.

These locomotives will take 5000 tons over the saw-tooth profile with maximum grades of 0.72 per cent, using their high maximum power to keep the average speed up and overcome the grades by momentum. Each unit will replace three of the present freight cabs and will increase the average speed with a 5000-ton train by about 40 per cent on level track. These locomotives were built by Baldwin-Westinghouse. Five more essentially duplicate, have been ordered from General Electric Co.

In the first five locomotives, substitute materials are used to a certain extent and on the second order a further substitution has been made to save, on each locomotive, as follows:

Brass, by redesign of bearings, thrust plates, bells, and marker lights	445 Lb
Copper, by substitution of iron pipe and fittings	1250 Lb
Tin, by elimination of some soldered joints	10 Lb
Rubber, by redesign of hatch cover gaskets	44 Lb

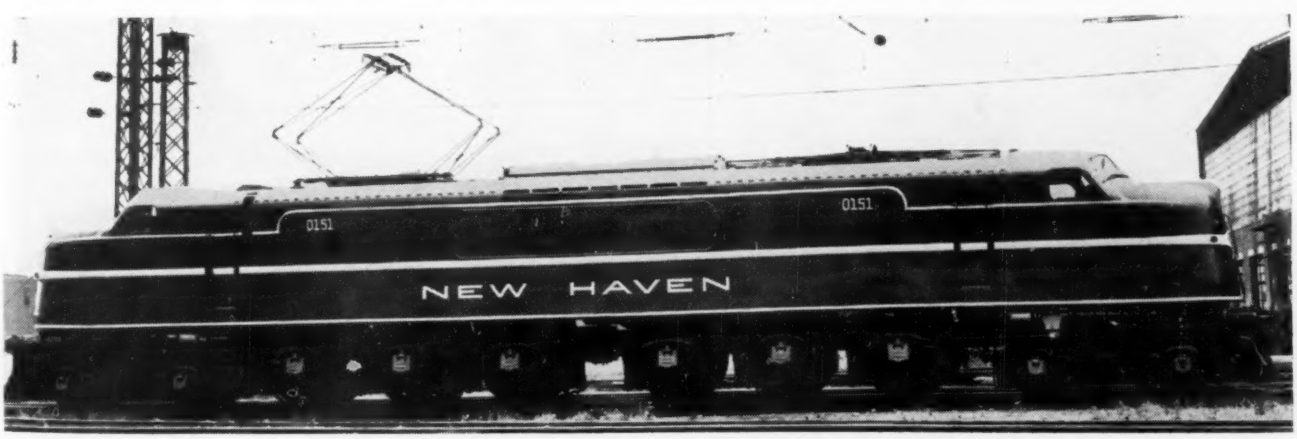

FIG. 13 NEW HAVEN 4-6-6-4 ELECTRIC (BALDWIN-WESTINGHOUSE)

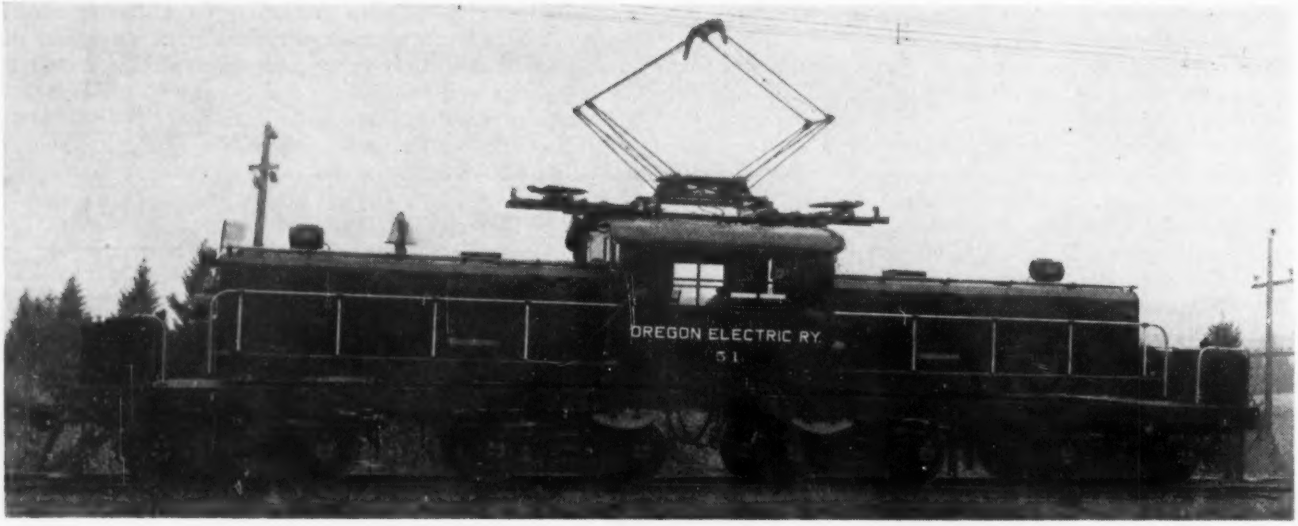

FIG. 14 OREGON ELECTRIC RY. FOUR-TRUCK ENGINE (COMPANY SHOPS)

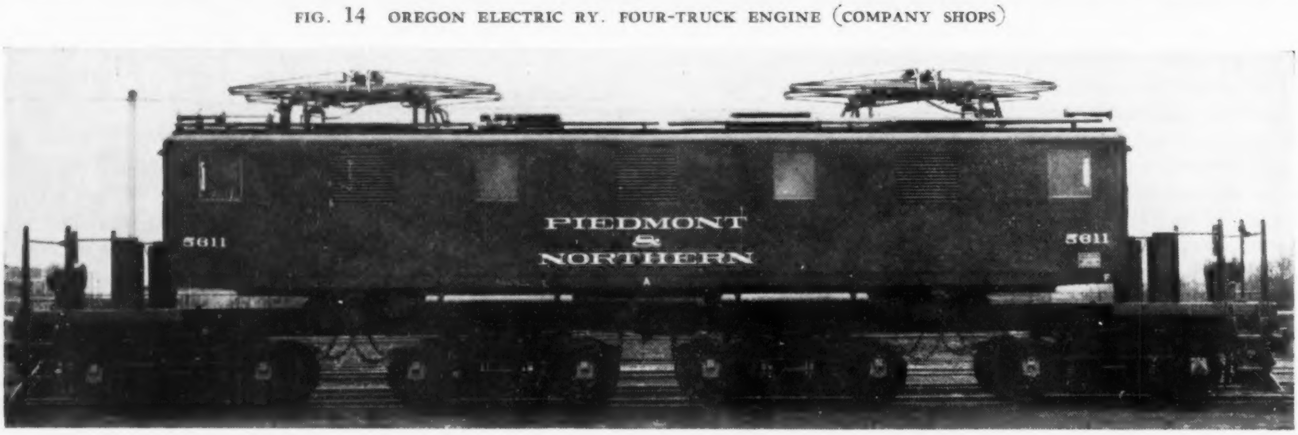

FIG. 15 PIEDMONT & NORTHERN FOUR-TRUCK LOCOMOTIVE (G.E.)

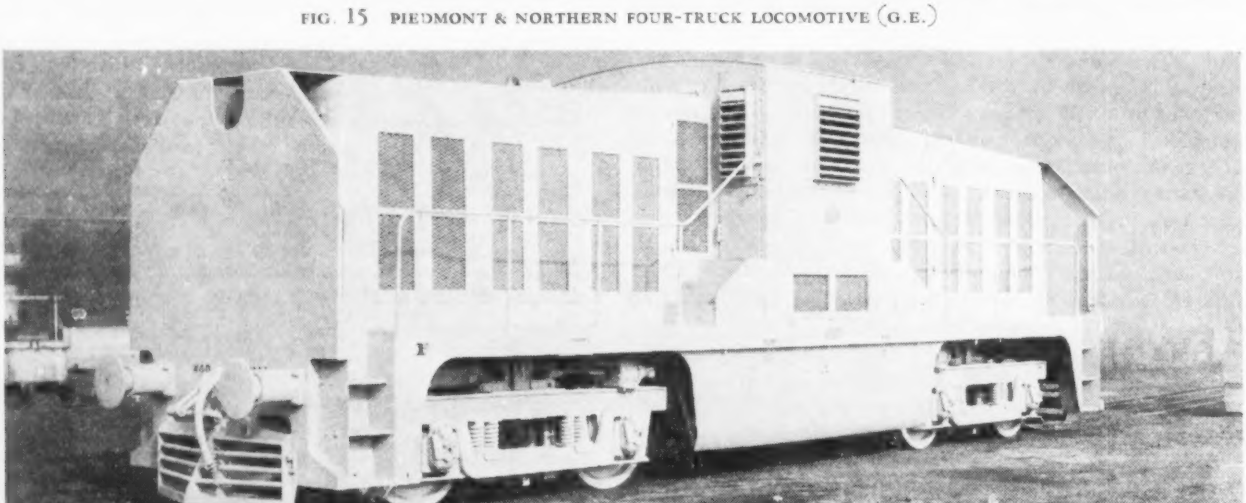

FIG. 16 WAR DEPARTMENT DIESEL-ELECTRIC FOR MILITARY SERVICE (WHITCOMB)

These savings are in addition to those made by the use of emergency material specifications.

At various times electric-motor trucks from multiple-unit cars or small locomotives have been used to build up larger locomotives, with four-motor trucks. This is a way to salvage equipment and get a locomotive out of what might otherwise be scrap.

A good example is locomotive No. 51 of the Oregon Electric Company, built by the Spokane, Portland, and Seattle Railway and by the Oregon Electric Railway out of old trucks, eight old motors, and much other scrap, the principal new equipment being gearing and controllers. The locomotive weighs 100 tons and rates 1080 hp for one hour. With other reconstructed locomotives, increased traffic is being handled with very moderate expense (Fig. 14).

The Piedmont and Northern Railroad is another which has built this type of locomotive and found it so satisfactory that an all-new locomotive of similar design has been put in service. This locomotive weighs 118 tons on eight driving axles, rates 2400 hp for one hour, and has a maximum speed of 70 mph (Fig. 15).

Among the many Diesel-electric locomotives bought by the War Department during the last year are ninety-two 65-ton commercial-type locomotives for main-line use and switching and five heavy-duty switching locomotives from several builders, including the Whitcomb Locomotive Co. The first group is represented by the following data:

War Department 60-ton heavy-duty Diesel switcher

Builder	General Electric Company
Total weight in running order, lb	120,000
Horsepower rating, hp	420
Maximum tractive force, 30%, lb	36,000
Maximum speed, mph	40
Diesel engine	
Make, type, no. of, engines	1-Cooper-Bessemer ENL-8
Full-load speed, rpm	900
No. and size of cylinders	8—8" $\times$ 10$^1/_2$"
Wheel diameter, in	38

The second group are specifically designed for desert military service and are represented by Fig. 16 and the following table of data:

War Department 65-ton road and switching locomotive

Builder	Whitcomb Locomotive Co.
Total weight, lb	144,000
Horsepower rating, hp	650
Maximum tractive force 30%, lb	48,200
Maximum speed, mph	46
Diesel engines	2—Buda supercharged, Model 6 DHS-1879
Number and size of cylinders per engine	6—6$^3/_4$ $\times$ 8$^3/_4$
Wheel diameter, in	38

Concerning this second design a representative of the Whitcomb Company offers the following interesting comment:

The problem was to design a locomotive with a very low axle loading and at the same time incorporate sufficient power to haul the prescribed tonnage in the highest speed range. In addition to providing adequate engine cooling with a very high atmospheric temperature it was necessary to provide maximum protection against desert sand. Furthermore, the most critical points on the locomotive had to be enclosed with armor plate as a means of attempting to discourage the personal attentions of Jerry and his Stuka Dive Bombers. While these were perhaps the most important items which our engineering staff had to solve, they do not by any means represent the full complement. Along with the European system of buffers and screw couplers were included vacuum brakes for the train line and straight air on the locomotives proper. The welfare of the engineer could not be ignored and every attempt was made to insure his comfort against both the elements and the enemy. After all, there is small profit in developing a locomotive which will withstand the most abusive treatment unless you can, as far as humanly possible, arrange to keep an able-bodied engineer at the controls. Every effort was made to have the parts interchangeable on all locomotives. Inasmuch as the total quantity was covered by three separate contracts, you, as an engineer, can unquestionably appreciate just what that meant.

The attached photograph (our Fig. 16) illustrates the manner in which most of the foregoing details were handled. The cooling radiators are mounted at the cab end of the hood and all air entering this chamber, as well as the entire engine compartment, passes through oil-type filters. The blower fans for the traction motors are driven direct from the main generator shaft and give ample supply of air to each motor. This insures the proper pressures within the motor to eliminate excessive heating as well as the entrance of sand or grit. The entire cab is fabricated from face-hardened armor plate as are also the end shields and top section of the engine compartment hood. On the train line we must hold the vacuum at 21 in., which means the entire system is virtually bottle-tight.

The New Haven is placing in service an order of Diesel-electric locomotives designed for both freight and passenger service. These are double-cab units, each finished to passenger power standards and equipped with steam heat and train-signal system. There are two 1000-hp engines in each unit, each supplying two traction motors. The trucks have six wheels each with traction motors only on the outer axles. Each engine has six 12$^1/_2$ $\times$ 13-in. cylinders, supercharged, delivering 1000 hp at 740 rpm. These units are operated in pool service on very short turn-around time, and it has been found feasible to run them without the provision of relief power at terminals.

BOARD OF INVESTIGATION AND RESEARCH

The Research Board under the Transportation Act of 1940 promises to be an important factor in the future thinking of transportation officials. It cannot possibly accomplish the purposes it has laid out for itself without extensive investigation of the economics and engineering of many processes now in vogue, many items of equipment and improvements which in general seem more or less imminent. As an example of this they propose to study the roller bearing as a factor in the construction and operation of engines and cars. From information now available it is recognized that in the streamliner service the roller bearing is already a "natural" and that it has given a most creditable account of itself in all passenger and locomotive service. Perhaps the Research Board will eventually tell us with official authority whether the roller-bearing installations, in view of their cost, life, and performance, really belong in a considerable share of our 1,600,000 freight cars.

CAR CONSTRUCTION

One of the radical departures of the year just passed was the equipping of one of the new streamline Empire State express trains with Budd disk brakes.

The so-called "Pendulum" car developed experimentally by the Pacific Railway Equipment Company was examined in a previous report of this series. The principle involved is the support of the car-body weight on special trucks having long coil springs (ten-inch deflection) extending 26 in. up into the body of the car. The trucks are held in position relative to the car body by lateral springs attached rigidly to the side of the truck and extending between the body support bulkheads to a point above the center of gravity of the body. Longitudinally, they are held in place by thrust tubes—"wagon tongues"—anchored in rubber near the center of the truck frame and at the other end to the car underframe. The rubber mountings of the longitudinal connections permit angular and lateral movement as necessary on curves. The cars accommodate from 58 to 68 passengers, according to the amount of lounge space provided.

The truck frames are welded of high-tensile low-alloy steel with 5 $\times$ 9-in. roller-bearing journals and 36-in. rolled-steel wheels. The general appearance of one of these cars is shown in Fig. 17. The stressed-skin construction of the body, with adequate longitudinal stiffeners closely spaced, combined with heavy end construction for collision safety results in a very light car body, the total weight of the car being 109,000 lb.

Three cars were built, each with specialties conforming to the practices of the owning roads (Sante Fe, Burlington, and Great Northern). These cars have been run together as an exhibition train and apparently give best performance in smoothness of ride and quietness when so coupled, but they have also been proved to be easy riding and very quiet when coupled with regular cars.

The "battleship" passenger car, in which no attention whatever was given to the matter of weight saving, seems to have definitely been shelved in the construction of new "conven-

tional equipment" in favor of new methods which conserve all the strength of the heaviest cars but which save one fifth or more of the total weight. Illustrative of this trend are new C.&O. coaches which include air-conditioning equipment with a weight slightly less than 70 tons ready for service. These cars have a coupled length of 80 ft $5^3/_4$ in. and carry 80 passengers, 20 of these in a partitioned-off smoking or "Jim Crow" section. They have double sets of toilet facilities. The main center sills have 21.3 sq in. area, meeting U. S. Post Office Department and A.A.R. standards for new passenger cars. The cars have a neat turtle-back roof and sealed outside sash but no skirting. The truck has six wheels with straight equalizers bearing on the boxes inside the frames. As additional anti-telescope protection the vestibule end posts have been carried through the buffer casting to a distance of 22 in. above the rail.

An export car order of exceptional interest was filled by the American Car & Foundry Company in the construction of three steel coaches for the Mozambique Railways. The order included cars with combination first- and second- and third-class accommodations for a 3-ft 6-in. gage line and third-class passengers for a line with $29^1/_2$ in. gage. The mixed cars seat 12 first-, 32 second-, and 80 third-class passengers. The third-class cars, shorter and narrower still, seat 80 passengers. Construction is of low-alloy, high-tensile steel. The mixed coaches have center entrances, and employ vertical plane "MCB" couplers; the $29^1/_2$-gage all-third-class cars have end entrances and link-and-pin couplers. The composite cars weigh 74,500 lb; the $29^1/_2$-gage cars weigh 48,500 lb.

The "refrigerex" container system, coming into continually wider use by the Railway Express Company, represents a definite forward step in the handling of cold shipments. The container is a double-walled iron box with 4 in. of spun-glass insulation and a capacity of about 10 cu ft, which can be handled at any Railway Express station and is adaptable to small shipments of ice cream, frozen fish or oysters, and other foods and has proved extremely important in the operation of the Red Cross "blood bank" system. The ice bunker holds 90 lb of water ice or 100 lb of dry ice, and when precooled to the desired temperature will be maintained for four or five days. The empty container weighs only 220 lb. The device was developed by the Church Freight Service, New York.

The tendency toward providing more comfortable, stronger, and safer cabooses continues all-steel construction, heavier sills giving desirable extra strength for pusher movements, the elimination of the cupola in favor of side bay windows are predominant characteristics. An interesting development is found in a car built in the Missouri Pacific Shops, which is a combination caboose and freight car. A little passenger space is provided and the freight end is a convenient "peddler-car" for way-freight service. This freight end has doors which readily admit one of the "portakold" refrigerator containers.

JOURNAL BEARING RESEARCH

In January the Mechanical Division began a study of possibilities of reducing strategic metals used in journal bearings in the laboratory of the Railway Service and Supply Corporation of Indianapolis. It has been found possible to reduce the weight of both backs and linings with minor changes in design; the result is a cooler running bearing and no reduction in load-carrying capacity.

In construction of 750 new boxcars the Canadian Pacific substituted 5-ply veneer, $^5/_8$ in. thick for 0.1-in. steel sheathing and saved 2063 lb of steel per car. The railway made a practical test of this arrangement before installing in the new cars by removing the steel sheathing of an existing car and substituting the wood. The experimental car met all service tests satisfactorily.

The *Pioneer Zephyr* of the C.B.&Q. passed its millionth mile Dec. 29, 1939, and is nearing its two-millionth mile. It was put into service in November, 1934, having previously been widely exhibited, including a stay at the Century of Progress Exposition in Chicago, and made the notable 1015-mile run from Denver to Chicago to inaugurate that part of its "career." Its most recent assignment is a 456-mile daily run between Lincoln and McCook, Neb.

A joint research project initiated by the Chrysler Corporation and co-operated in by the New York Central, Pennsylvania, and the Pullman Company has greatly increased information on the "ride" obtainable from passenger trucks. The improvements indicated are particularly adapted to the reconditioning of existing trucks and consist of the application of positioning links to control the lateral position of bolsters and metal spring covers to insure that the contact surfaces of elliptic springs remain in good condition.

An event in the saga of the Diesel-electric motive-power era which cannot well be passed over is the picture of the car bodies of the famous M-10,000 (later the *City of Salina*) lying upside down, stripped of running gear in a well-known metal scrap yard. Is this a contribution toward the moot question of "economic life" or is it just something else?

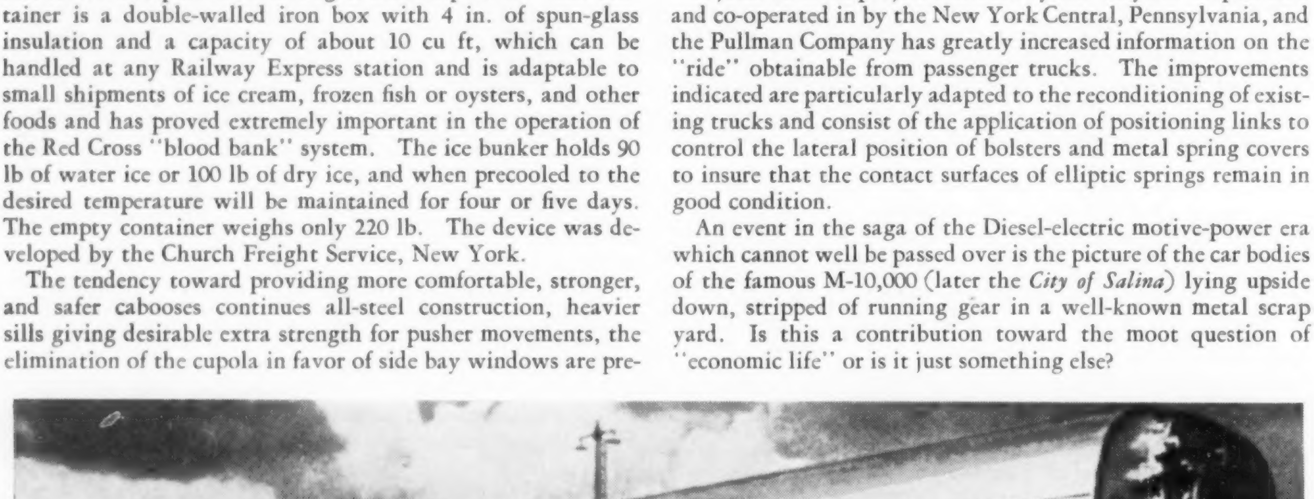

FIG. 17 SANTA FE "PENDULUM CAR" (PACIFIC RY. EQUIPMENT CO.)

MUSIC *in* INDUSTRY

By HAROLD BURRIS-MEYER

STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

A LONG time ago, there were many kinds of work which couldn't get done without music. Sea chanteys and work songs are a part of our cultural heritage. Even in our time, the negro singer, often a preacher, was hired to lead the singing for the gang loading river boats. The songs which are associated with work came from a time when people set some store by the dignity of work and the privilege of working; and to a certain extent they reflect those ideals.

Amid dislocations brought about by industrialization, one of our serious losses lies in the fact that music has gone out of work. When you separate work and song, you make work out of work. Nobody knows who discovered the interdependence of work and music. It is fortunate that that phenomenon has been rediscovered at a time when more and more work seems to be our lot. With the revived consciousness of the place of music in work, and the appreciation of its value, it is natural that the question of why the music works should be raised. The answering of that question is the subject of this paper.

The investigation on which the writer takes this occasion to report had its origin in a research enterprise directed toward the control of sound for theatrical purposes. In the course of the investigation, it became apparent that the auditory stimulus is more powerful than any of the conventional means by which the showman can exercise emotional control over his audience. After we found out how easy it was to make people laugh and make them weep, we set out to discover what it was about the auditory stimulus that made it so powerful a device. In order to get a good test situation in which we had control over the stimulus, and in which the subject was not aware of the fact that he was a subject, we directed our preliminary studies toward music in industry.

SOUND SYSTEMS IN FACTORIES

Industrial music electronically distributed is quite new. We hoped that, by a study of existing factory records for periods prior to and after the employment of music, we could find out what the music did. However, the kind of data from which it can be determined what music actually does have, proved to be sadly lacking. Instead of facts we have hearsay, hunch, and theory, all readily available in almost any quantity. Managements which use music and employees who listen to it seem to agree that music is a fine thing. Organizations which install electronic distribution systems and furnish programs have files full of letters from satisfied customers. There is a growing popular belief in this country that music in a factory can do just about everything except rearrange the stock room or interpret the latest set of government regulations.

Evidence to show how good industrial music is, based on casual or superficial observations, is freely adduced. Everybody who gets his hands on a plant music-distribution system at once becomes an expert and can tell you everything about programming, speaker placement, intensity levels, what the boss thinks about it, what the employee thinks about it, how little either of them knows about it, and what a good thing it would be if somebody had consulted him first. Employers sometimes ascribe to their employees their own reactions and opinions. One company gave up playing music because it interfered with the factory intercommunication system. Another executive would not install a system because, said he, "If I get it in and I don't like it, the employees will never let me take it out."

All this adds up to precisely nothing we can use. Even a report published by the Medical Research Council of the British Industrial Health Research Board is of limited use because, though the studies it treats are thorough, they apply only to a group of girls working in a chocolate factory.

DEVELOPING A TECHNIQUE FOR STUDYING EMOTIONAL CONTROL

As indicated, our interest is in emotional control. We are interested in exerting it directly by emotional stimulus, and by inducing physiological change as the basis for emotion. The ends to be achieved by emotional control are in industry obviously to suit the man to his task, to give the work the status of a metier, to make it for the man, not what he lives by, not that which produces the pay envelope, but a major element in living. If that can be done, even if only in part, the work improves and the employee likes it. If you have control of the stimulus, if you can define it in terms of intensity, spectrum, and cyclic quality, and then measure the rate and quality of production, lateness, early departure, absences, accidents, and any discoverable indexes of employee morale, without the worker's knowledge that he is a subject, you have a valuable technique for the study of emotional control and can, incidentally, find out what music in industry is good for, and how good it is.

As a starting point, there is a considerable mass of physiological and psychological data. By auditory stimuli, we can control metabolism (Tartchanoff and Dutton). We can increase or decrease muscular energy (Feré, Tartchanoff, and Scripture). We can increase respiration (Binét, Guibaud, Weed). We can increase or decrease pulse rate (Grétry, Hyde, Scalapino). Try that on yourself sometime. Take your pulse while you sing; change the tempo of the song and you will observe a change in your pulse rate. We can control the threshold of sensory perception (Kravkov, Diserens, Urbantschitsch), and this is very important in precision work. We can reduce, delay, or increase fatigue (Diserens and Tartchanoff). By the control of these phenomena it is possible to establish a physiological basis for the generation of emotion (James Lange).

Unfortunately, the phenomena mentioned have been studied only under laboratory conditions. The subject often knew that he was a subject, and that somewhat conditioned his response. Moreover, he was not engaged in his principal activity while being tested, nor did he share his reactions with a group. The extremely important phenomenon of mass reaction has been neglected. Obviously then, even our basic theory when applied to music in industry needs validation in the factory.

BASIS OF FACTORY STUDIES

Accordingly we proceeded to study existing musical programs in factories and then to assemble programs for specific purposes. It has been our good fortune to have the co-operation of numerous industries and of two organizations dealing in factory music-distribution systems and music libraries, Muzak, Inc., and Radio Corporation of America. Lacking the kind of factory records susceptible of statistical analysis for our purpose, we had to get them ourselves. Also, since our study has been

An address before the Metropolitan Section of The American Society of Mechanical Engineers, New York, N. Y., October 15, 1942.

limited by funds and personnel and will come to an end presently because of the war, we have been able only to employ a sampling technique. We have not been able to study accident rates. We have not yet been able to establish or evaluate satisfactory indexes of employee morale. We have a lot of ideas about such indexes but no figures at the moment. The data we have are indicative. They are not sufficient to form the basis of unassailable conclusions, but we believe they show which way the wind blows. We set about to measure the most obvious thing—does music in the factory influence the production rate? All the charts here presented were drawn from data taken under

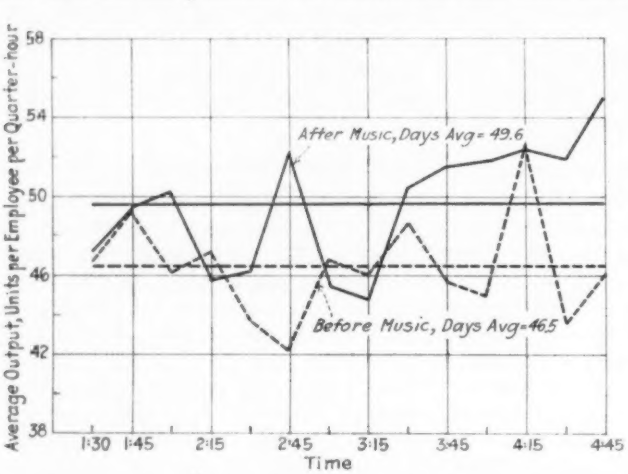

FIG. 1 GROUP AVERAGE OUTPUT CURVES, BEFORE AND AFTER MUSIC INSTALLATION

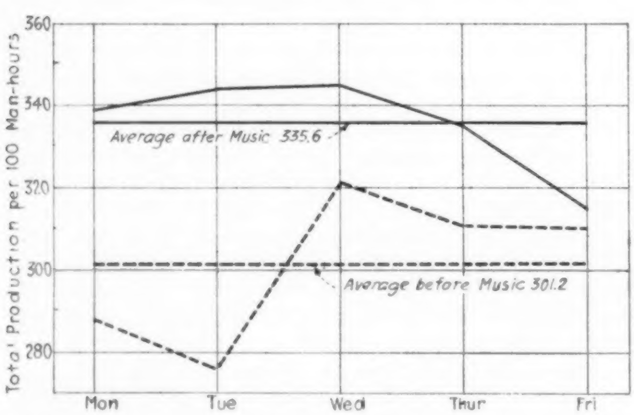

FIG. 2 PRODUCTION PER 100 MAN-HOURS, ONE WEEK BEFORE AND ONE WEEK AFTER MUSIC INSTALLATION

controlled conditions. No figures are used where there were significant changes in weather (temperature, humidity, light), or ventilation, or noise, from day to day; or where there was other than normal labor turnover, or any labor-management quarrel; or where there was any plant change in terms of machine arrangement or color, or variation in process or product.

Fig. 1[1] shows the unit output per employee, plotted against time. The dotted curve shows a day without music, the solid curve a day during which music was used. The conditions prevailing on the two sample days were identical in temperature, humidity, ambient noise level, ventilation. The group consisted of sixteen experienced employees. It will be noted that the curves are in both cases erratic, but the horizontal line which defines the total area under the curves is considerably higher where music was used than where it was not. The difference amounts to 6.25 per cent based on the average before music. In more than 75 per cent of the measurements of this sort in all the factories studied, we have found the area under the curve, or total production, to be greater when music is used than when it was not used.

Fig. 2 shows the total production per 100 man-hours during two typical weeks, one before and one after a music installation was made, and represents the average for a group of approximately 100 employees of all degrees of experience. The difference amounts to 11.4 per cent.

Fig. 3 shows what happens to production when musical installation is made. Each block represents the average production per 100 man-hours in one week. It will be noted also that

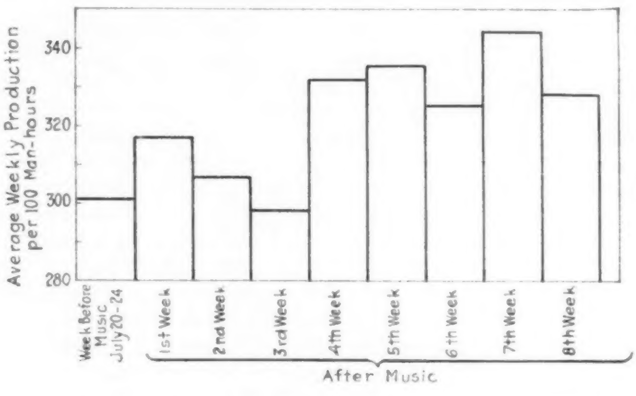

FIG. 3 PRODUCTION RECORD AFTER MUSIC INSTALLATION

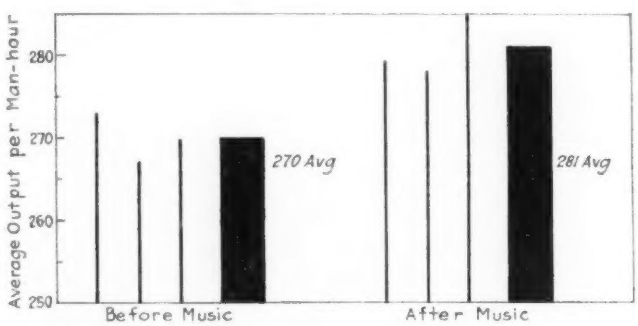

FIG. 4 EFFECT OF MUSIC WHEN MORE DIFFICULT WORK IS BEING PRODUCED

in only one week was the average production lower after music was used than in the control week before musical installation.

Fig. 4 shows a similar result in another factory. In the case of the latter, the operation studied was one requiring a very high degree of manual dexterity and a sense of timing. Employees were on piecework as in the case of Fig. 3. The average difference is 4.07 per cent. Each line represents a week, and the blocks show the average during the periods of study.

These charts would seem to indicate then that music makes work go faster and, since all the foregoing graphs were made where piecework prevailed, the employees profited by the changes introduced by the music.

ABSENCES, DEPARTURES LESSENED BY MUSIC APPEAL

A concomitant of the production rate is the problem of Monday absences and early departures with which some industries have to contend. Sample graphs for each of them are given, which are typical of all the data we have been able to get on the subject. The first graph, Fig. 5, shows what happened in a

[1] The data for the original drawings of the nine illustrations in this paper were prepared by R. L. Cardinell of Stevens Institute of Technology.

plant where the employees were on piecework and where they got tired and went home early, before the musical installation was made, and did not do so much of that when there was music to listen to. The graph shows two sample weeks and an average before the musical installation; and four weeks and an average in which music was used.

Fig. 6 shows what music does to Monday morning absences. The lines show the percentage of absences per week for four average weeks before, and four after music installations were made; and the blocks show the four-week averages.

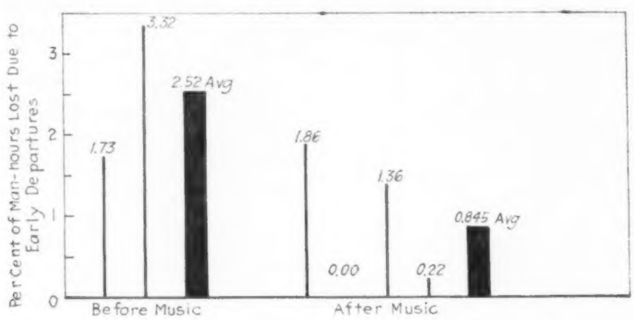

FIG. 5 EARLY DEPARTURES BEFORE AND AFTER MUSIC INSTALLATION

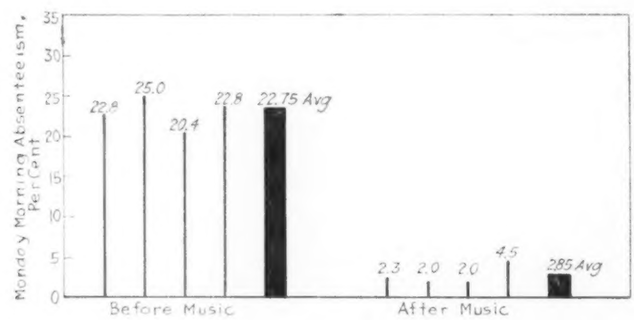

FIG. 6 EFFECT OF MUSIC ON MONDAY-MORNING ABSENTEEISM

PROGRAMMING FOR THE FACTORY

Having answered definitely, though for not too many factories, the question of what music does to the production rate, we set about examining the kind of music and when it was played. Programming is, as may be deduced from the laboratory data on auditory stimuli, of great importance. It is now practiced in conformity with theatrical principles plus observation and experience. There is a considerable divergence of opinion among those who arrange programs on the question of the number and length of playing periods; the relative values of associative and nonassociative music; the value of popular jitterbug versus classical music; the relative value of vocals and instrumental music. It is generally accepted practice, however, to limit playing time to not more than $2^1/_2$ hours per day, in periods of 12 to 20 minutes. Marches for opening, and marches and popular foxtrots for change of shift or closing time, are most generally preferred. Music during the last 20 minutes of a work period is generally not employed since it might be taken as a signal to get ready to go home. Special radio programs, especially those planned for music in industry, are occasionally used. "Deep in the Heart of Texas" is out. It stops all work in the United States and in England because, naturally enough, the employees feel obliged to drop all work to join in the hand clapping in the chorus. The "Strip Polka" is shunned for obvious reasons. Hymns are said to be in considerable demand on Sunday in some factories, though it has been observed elsewhere that hymns can stop work about as fast as a fire gong.

Luncheon periods are considered the most flexible in programming and often carry recorded messages to the folks back home from the men in service, bond sales talks, news reports, hot numbers for the jitterbugs, salon music alleged to aid digestion, request numbers, etc. Some factories ban vocals during work periods, others like them. Employee demand for music rises at night, and music is a source of comfort during blackouts. One factory played "Take Me Out to the Ball Game" as the World Series started and announced the score every third inning. It is obviously impossible to make the value of many of these program elements the subject of statistical analysis. But the mere diversity of the opinion and material seems to indicate that one kind of a program should be better than another, especially in the case of a specific set of conditions or type of operation.

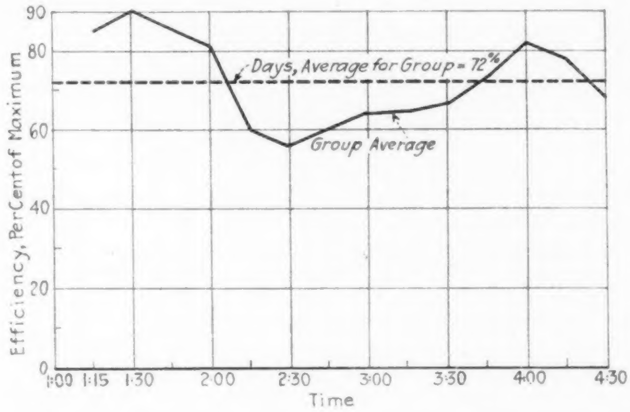

FIG. 7 PRODUCTION CURVE A YEAR BEFORE MUSICAL SYSTEM WAS INSTALLED

So far as can be discovered no one has gone down to bedrock on the subject. The empirical development of a system of programming would be all right if records of results were kept. The development of a program from psychological and physiological data at hand is another approach to the problem of programming.

PLANNING A PROGRAM FOR A SPECIFIC PURPOSE

We have been able to undertake only one experiment in this field designed to demonstrate that a musical program planned for a specific purpose can accomplish that purpose. The factory had had music for 6 months. Programming was provided by the organization which installed the distribution system and was, so far as we were able to evaluate it, a better than average program. It consisted of numbers especially arranged and recorded for industrial use, arranged on the basis of experience and observation, and reproduced with high-fidelity equipment.

We were unable to obtain any production figures of our own for the period before music. However, we went back to some records which the company had kept approximately 1 year before this experiment took place, and, although we cannot vouch absolutely for the conditions obtaining at that time, we believe that Fig. 7 gives a fairly representative picture of what their production curve looked like at that time. You will note that the average here is 72 per cent. As the subsequent graphs will show, there was an increase of 8 per cent with the installation of music, and 14.8 per cent with a planned-test musical program.

The production curve, Fig. 8, showed a reasonably uniform pattern involving a sharp dip at approximately 2:15 in the afternoon. The test program was planned with the sole purpose of knocking the bottom off the 2:15 dip. Fig. 8 shows a typical

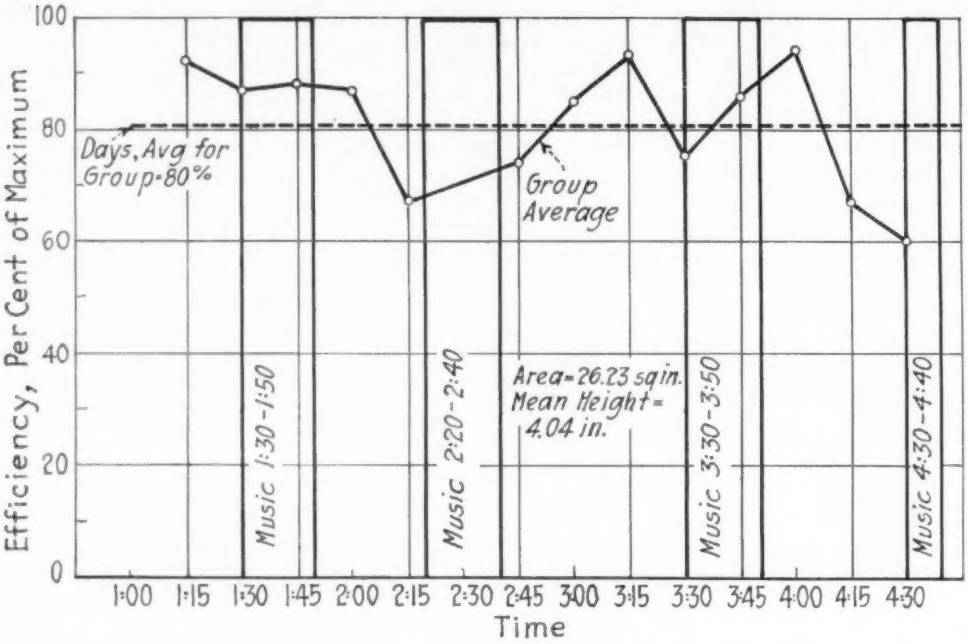

FIG. 8 PRODUCTION CURVE WITH STANDARD PROGRAM AT INTERVALS

day with the standard program. Fig. 9 shows a typical day with the test program. You will note on the second chart that the 2:15 dip has been reduced approximately 20 per cent, and also that the total day's production (area under the dotted line) has been increased in the case of the test program 6.8 per cent. This would seem to bear out a theory to which the writer has long subscribed which is that, while music is better than no music, programming will not be satisfactory until it is undertaken on the basis of a careful analysis of the results. More statistical analysis of factory performance should teach us much.

It is believed that programming must ultimately be undertaken for the factory, if not for the specific operation. Fatigue curves vary in shape and amplitude, and it is difficult to find one remedy for dips occurring at different times in different operations. We have, at least, established the fact that the remedy exists and the technique for employing it is in hand.

Whether we like it or not, music in industry appears to be here to stay and bids fair to be of increasing importance as time goes on. It has been indorsed by responsible officers of both the A.F.ofL. and the C.I.O. Factory sound installations are now mandatory in England. This is primarily to avoid loss of time in the case of air raids by not calling the employees out until the last moment, but so far as can be discovered, more factories appear to use the systems for music than do not. Numerous radio stations here and in England carry musical programs planned for broadcast to factories. Once the sound system is in, music comes in with it. The number of factories employing music in this country grows so rapidly that statistics of this week are no good next. Installations progress and programming improves. Music works but we still have a long distance to go before we can make the work sing.

Little of the music used in the factory is germane to the endeavor it accompanies. The work song took not only its rhythm but its mood and lyric from the work operation. The transcription carries something composed for the concert hall, the stage, or the night club. At best, it is only adapted to industrial use by reorchestration and arrangement. Leisure music is not in the idiom of the modern industrial plant and yet the industrial audience will at the present rate soon be the largest audience for the musician.

No artist undertakes a composition or performance without the consciousness of his audience, and in so far as his art is valid, he undertakes to exercise emotional control over that audience. When the composer starts to think of his work as being first and most often performed in a factory, before people who are working while they listen; when he proceeds as some composers are already doing, by treating proved auditory emotional stimuli according to a musical pattern; when he sets for himself the task of making the work sing, then we may well have a musical idiom which is something new on the face of the earth; and what industry can do for music may be as important when the record of this civilization is written as anything music can do for industry.

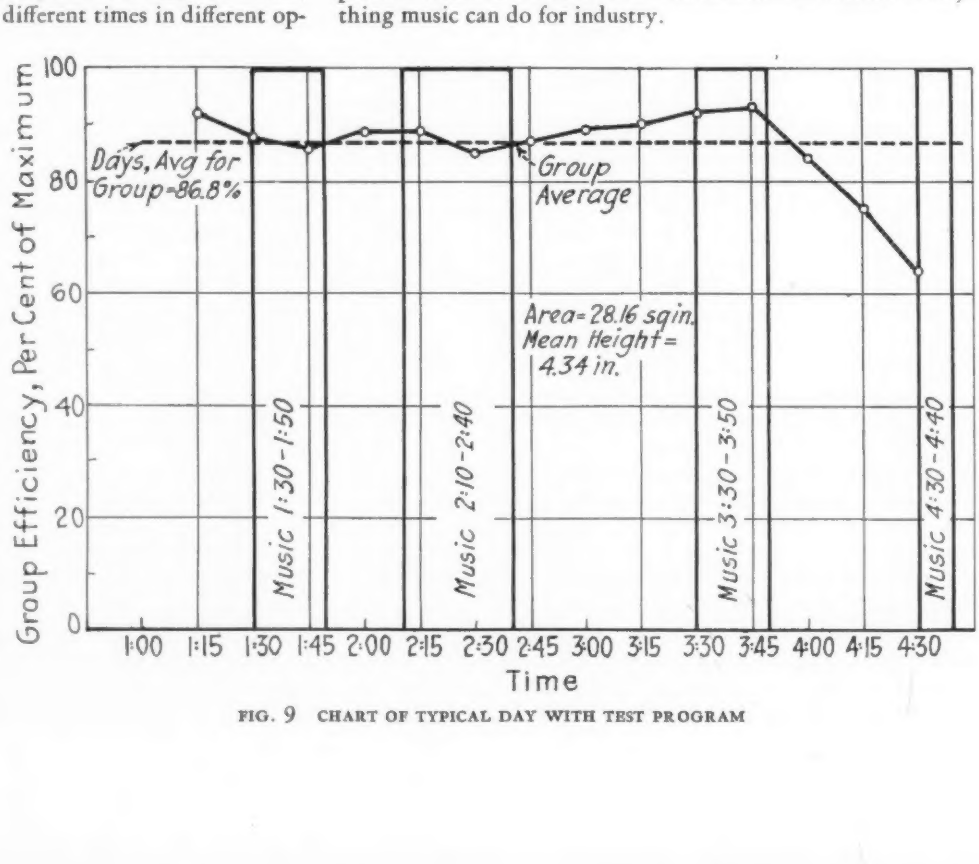

FIG. 9 CHART OF TYPICAL DAY WITH TEST PROGRAM

CARGO GLIDER PICKUP

By RICHARD C. du PONT

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IT IS a popular conception that the airplane, as typified by the modern air liner, is an extremely flexible instrument of transportation and that it can fly anywhere subject only to the limitations imposed by fuel and the fact that it cannot be operated from a daisy patch. As the sky is trackless, this conception is perhaps natural and to a large degree it is true. Since the outbreak of the war, many of our commercial air liners have been mobilized and transplanted from their regular runs to military routes and missions that today are taking them to every part of the world. These aircraft are doing an incredible job and their swift transition from a peace to a war basis, occurring almost overnight, is proof of the extraordinary flexibility of the airplane in these circumstances.

Nevertheless, the modern air liner is not as flexible as is commonly supposed, and its limitations become perceptible when it is flown in scheduled operations, particularly where the routes are relatively short and stops frequent. Here its versatility rapidly diminishes, and it is found that after all there are tracks in the sky other than those established for safety's sake to which it is geared, the same as ground transportation is geared to rails and highways. These tracks have been largely created by the growing speed and size of the airplane itself.

In the evolution of our domestic air-transportation system, the trend has been constantly toward bigger and faster airplanes. What the new industry had to offer the traveling and shipping public was speed. What the industry needed for economical operation and to place the cost of air transportation on a reasonable level was more pay load. These two forces, combined with keen competitive conditions in the industry itself produced the modern air transport but in the process its flexibility steadily disappeared. The industry learned that the new aircraft could not be profitably operated over routes requiring stops at short intervals because the time lost on the ground neutralized their greatest asset. The industry also found that many air-line cities did not have airports large enough to accommodate the bigger and faster ships while at others the traffic no longer justified the improved service. As a consequence, the domestic air-transportation system began emerging largely as a high-speed through service between large metropolitan centers of the country.

Take a look at the domestic air map today. Impressive? Yes, but a close examination reveals that actually it covers only 355 cities and this number includes the 115 communities that are on the air-mail pickup system. Of the 240 designated stops on the trunk lines, many had been suspended even before the war either because their geographical proximity to other points on the same route made it impracticable to serve them or because their airports were inadequate. It might be said that these places have been by-passed by progress. In 1934, our air lines covered 178 cities. From the standpoint of service, expansion of the system to only 62 additional cities in eight years, which still leaves three quarters of our population without the advantages of direct air transportation, is a feeble record of growth.

During the past few years, while the major air lines have been moving at an accelerated pace in the direction of long-haul transportation, much has been heard in the industry about the development of short-haul or feeder lines, but little was done about it in a constructive way until Congress itself took cognizance of the inadequacy of the air-line system and authorized the air-mail pickup routes. The subsequent success of these routes suddenly revived intense interest in the possibilities of short-haul lines.

The air pickup system now operates in Pennsylvania, West Virginia, Kentucky, Ohio, New York, and Delaware. Covering communities which range in population from 500 to 120,000 and which are an average distance of 18 miles apart, it constitutes a short-haul operation that a short time ago few in the air-line industry visualized or thought could ever be practical or economical. No one was even dreaming of short-haul development scaled down to serving communities so close together, and it was more or less unthinkable that air-mail pickup lines, operating to cross-road towns and depending chiefly on air mail for revenue, could ever prove more than an expensive venture of an indulgent government.

STARTED IN 1939 AS EXPERIMENT

The air-mail pickup service was started by the Post Office Department in 1939 as an experiment. A little over a year later it was placed on a permanent basis by the Civil Aeronautics Board. It has now been in operation more than three years. In that time, the air-mail and express traffic has developed to a point where it is taxing the capacity of the fleet of single-engine Stinson SR-10C aircraft which were converted for pickup operation. From the air-mail revenues that the service is generating, the Post Office Department is recovering its cost and perhaps making a modest profit. Since 1918 when the air mail was first established, there have been only four years, and these all recent, when the air-mail receipts have exceeded government payments to the air carriers. There are now in the files of the Civil Aeronautics Board applications for additional pickup routes which would extend the service to 1400 more communities throughout the country. Unquestionably, a large part of the great expansion in air transportation that is anticipated after the war will be accomplished through the widespread establishment of air pickup routes.

Five routes, varying in length from 178 miles to 316 miles, are embraced in the present air pickup system. On the shortest route, there are 10 intermediate station points, or one for about every 18 miles. On the longest, there are 20 intermediate station points, or one for about every 15 miles. The daily schedules over all these lines are maintained at an average block-to-block speed of 110 miles an hour. At first it was 100 miles an hour, but it was afterward found that this speed could easily be stepped up to 110 miles an hour. There is no doubt that the air pickup planes in the future will operate at much higher speeds as faster and more suitable pickup planes are designed. The same forecast may be made about the load limitations. The equipment now in commercial operation is designed to pick up a dead-weight load of 50 lb. However, in tests it has successfully picked up 125 lb and in daily operation it has picked up loads of from 60 to 100 lb without trouble; equipment now in military use can pick up much heavier loads.

In the air pickup system, flexibility and speed, factors in-

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dispensable to the success of short-haul air transportation, are combined in the airplane. It has literally brought air service within the reach of every hamlet in the country, something that never could be done by the conventional development.

Of what pertinency is all this to the future of gliders in commercial cargo operations? Of what relevancy to the subject are these comments on the shortcomings of our domestic air-transportation system; the inflexibility of the modern air liner; the short-haul problem, and the development of the air pickup system?

SHORT-HAUL FIELD BEST FOR GLIDER

The answer is that the short-haul field, in my opinion, offers the best opportunity for commercial glider operations. In reaching this conclusion it has been necessary to examine the domestic air-transportation system to determine what territory remains for the potential development of short-haul or feeder lines, the problems confronting this development, and whether such operations will pay. The inadequacy of our transport system reflects the need. The air pickup operation has proved that short-haul operations are both feasible and profitable. Further, it has demonstrated that flexibility of operation is essential to the success of short-haul routes. It would now seem that, by employing the air pickup by which gliders can be picked up and delivered in the same fashion that air mail and air express are handled today on the air pickup lines, we could provide with flexibility a much needed cubic capacity for greater pay load. The possibility of using gliders in commercial transport operations has been under study for some time by the cargo-conscious air-line industry which is seeking the development of air freight as distinguished from air express. The industry realizes that to build up this traffic the ton-mile costs of air transportation must be drastically slashed, and that at present the airplane which will enable the industry to compete with surface carriers for this traffic on a cost basis is not in sight. The solution of the problem is more capacity and lower operating cost. As a means to this end, the glider attracted active interest, intensified by their spectacular success in transporting troops and war supplies.

At Crete, and in North Africa, it is known that the Germans used two types of gliders: one, capable of carrying 23 fully equipped troops and two pilots or a freight load of 5300 lb, and the other, a craft capable of carrying 10 troops and one pilot, or a freight load of 2800 lb. The freight capacity of the large glider is almost equivalent to that of a DC-3. These gliders were towed by a Junkers 52, a three-engine plane and general-purpose transport and glider tug which can carry a freight load of 4200 lb for a distance of 650 miles and has a cruising speed of 146 mph. It would seem logical that if the capacity of the airplane could be multiplied in transporting troops and military supplies by simply hitching on a glider, the same thing would be equally feasible in commercial operations.

The fundamental question is to what extent gliders can augment the transport plane. After careful study of the specifications of the Junkers 52, we can make the following analysis:

With a cruising speed of 146 mph, operating at 60 per cent horsepower, the plane has a range of 650 miles. Fuel consumption is 120 gal per hour. Using these figures, the weight of fuel consumption per mile is 4 lb. Using these same figures we find that with a range of 500 miles, a cruising speed of 146 mph, fuel consumption of 4 lb per mile, and with a crew of 600 lb and miscellaneous equipment of 400 lb, and an empty weight of 14,300 lb, we have a total of 15,300 lb. With a gross weight of 22,000 lb, we arrive at a net freight and fuel weight of 6700 lb. Subtracting 2000 lb of fuel, we have a net freight weight of 4700 lb. By the same method, we also find that with fuel for only 250 miles we have a net freight weight of 5700 lb.

Now let's consider adding a glider such as the Gotha 242, for which the Junkers 52 has been reportedly used as a tug. We have seen pictures and three-view drawings of this glider and know it is of only moderately clean design. Comparing this with other data available on the drag loads of gliders, I believe I am conservative in assuming that the effect of the additional drag of this glider on the Junkers 52 would not reduce the cruising speed of the combination to lower than 115 mph at the 60 per cent horsepower.

The Gotha 242 reputedly carries a pay load of 5300 lb and with the cruising speed of the combination now reduced from 146 mph to 115 mph, we find that the gas consumption has been raised to 5.1 lb per mile. On a 500-mile basis, with a glider in tow, the plane will use 2540 lb of fuel, will carry 4150 lb net freight, plus 5300 lb of freight in the glider, making a total load carried of 9450 lb. On a 250-mile basis, the plane will use 1270 lb of fuel, will carry 5430 lb net freight, plus 5300 lb of freight in the glider, making a total net freight of 10,730 lb.

Reviewing the foregoing, it would immediately appear that in the first case in a distance of 500 miles, through adding the glider, we had increased the load-carrying capacity of the plane by 4750 lb and in the second case, for a distance of 250 miles, it had been increased by 5030 lb.

Looking at the entire question in another light, however, experience in carrying overloads in aircraft of this approximate size indicates that it is not unreasonable frequently to run wing loadings as high as 30 lb per sq ft and power loadings upward of 12 lb per hp. Using the wing area and horsepower information on the Junkers 52, we could then, theoretically, by running the wing loading and the power loading up to these limits, run this airplane to a gross load of 29,000 lb. In operating at a 29,000 lb gross, I believe I am conservative in assuming the additional drag of the wing flying at a higher angle of attack would reduce the cruising speed at 60 per cent horsepower to not below 141 mph, which figure when used would cause a fuel consumption of 4.2 lb per mile. Now, an empty weight of 14,400 lb (100 lb added as structure to carry the overload), crew 600 lb, and miscellaneous equipment of 400 lb, giving us a total of 15,400 lb, will leave us a net freight and fuel load of 13,600 lb.

With fuel for 250 miles amounting to 1050 lb, we now have a net freight weight of 12,550 lb. With fuel for 500 miles amounting to 2100 lb, we have a net freight weight of 11,500 lb.

Now, comparing this Junkers 52 in the 29,000-lb overload condition with the previous condition in which it was towing 5300 lb in the glider, we find that in a 500-mile range it could carry 2050 lb more pay load and in the 250-mile range, 1820 lb more pay load than the glider-tug combination. This illustration seems to offset practically all of the theoretical efficiency to be gained in towing the glider, but it may only open an argument as to why we cannot tow the glider with a tug loaded to 29,000 lb gross. It becomes obvious that such arguments become ridiculous after a point as more important factors will enter the picture, which will definitely limit the amount of load that can be carried in the airplane or in the airplane-glider combination.

We cannot arbitrarily state that gliders can or cannot improve the load-carrying ability of any one plane by carrying more load in tow than can be carried in the plane itself. This statement cannot be categorically supported because it depends on what maximum overload the original carrier plane can be permitted to operate under, and such overload depends on the local conditions, the nature of the field, the altitude of the field, the weather, and many other items.

It must not be overlooked by those who believe that the use of gliders can improve the efficiency of a cargo operation, that the power required to carry the additional overload placed on

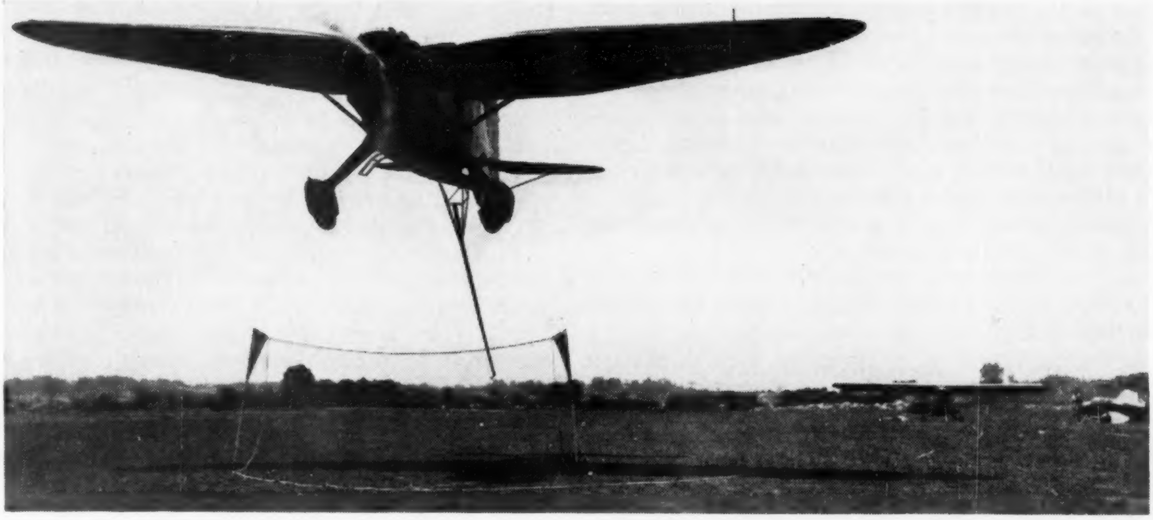

FIG. 1 ALL AMERICAN AVIATION PICKUP PLANE JUST PRIOR TO MAKING CONTACT WITH TOWLINE SUSPENDED BETWEEN GROUND STATION POLES IN FOREGROUND

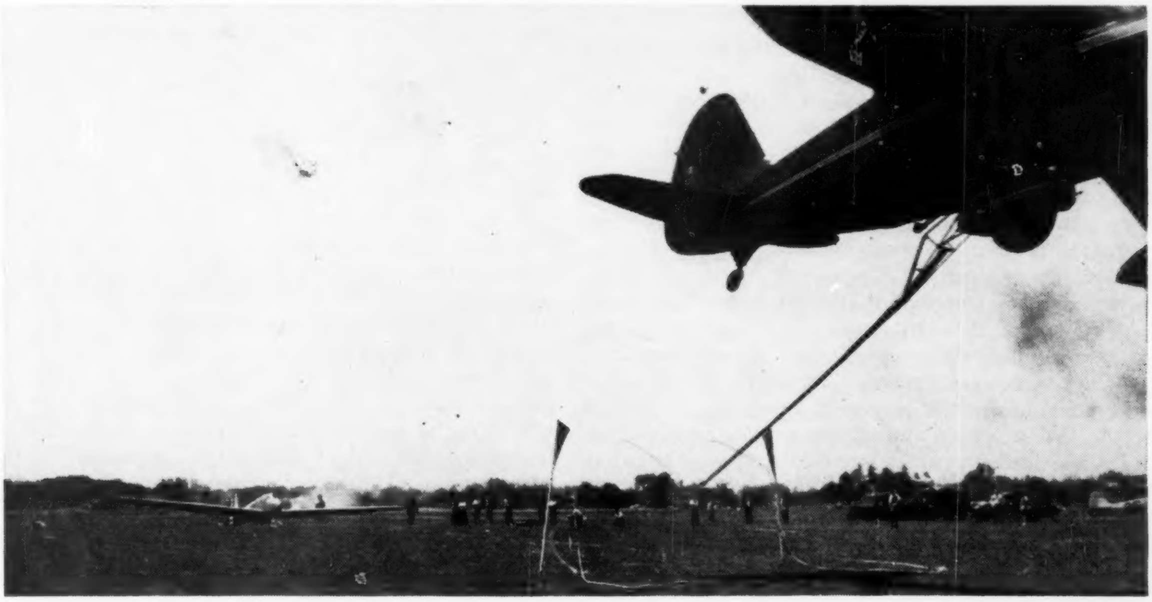

FIG. 2 PICKUP PLANE AT MOMENT OF CONTACT WITH GLIDER TOWLINE. GLIDER IN BACKGROUND AWAITING PICKUP

FIG. 3 GLIDER JUST AFTER PICKUP AND IN FULL TOWED FLIGHT. GROUND STATION POLES IN FOREGROUND INDICATE SHORT TAKE-OFF RUN NECESSARY BY THIS METHOD

a transport should be based only on overcoming the increased drag of the wings and only a very small increased drag on the fuselage, which power required would not be as great as the power required to overcome the entire drag of the glider. In other words, the additional load has not added to the size of the fuselage or the number of wheels, or the resistance of the wind shield or the number of other items that have given the transport plane a much higher drag than the glider.

The principal expense of carrying an overload on a transport plane has to do principally with the L/D of the wing, which is expected would be at least slightly higher in efficiency than the L/D of an entire glider, designed to carry the amount of the overload.

THREE MOST IMPORTANT ADVANTAGES

I am not prepared to enter into the highly controversial questions involved as to whether the over-all efficiency would be greater in air freight operations if the cargo were distributed among gliders or confined to a single unit. I do, however, wish to point out clearly what in my opinion are the three most important advantages that can be obtained through the use of gliders when combined with the air pickup.

When contemplating an air freight operation, when it seems desirable to overload an airplane the first question will be:

1 Are the runways where service is to be provided long enough to permit safe take-offs and landings?

2 Is the cubic capacity of the plane sufficient, and is it located in the proper place to provide proper balance?

3 Is the airplane strong enough to safely carry the overload?

We can, of course, assume first of all in designing a cargo plane that it will be strong enough to support a certain maximum placarded overload condition, that the cubic capacity will be provided in proper places to carry a considerable load, and that runways will be provided at communities that would justify a very heavy air-freight traffic. We must remember, however, that in filling these requirements, we are destroying flexibility and again creating tracks in the air that will prevent the public receiving the full benefits of aviation. It must be remembered that in short-haul cargo service, planes must be unloaded and loaded at their intermediate points and that while the planes are being loaded and unloaded, they are not earning money. It must be remembered that heavy cargo cannot be loaded and unloaded as quickly as can passengers who can walk on and off the airplane without help; and it must be remembered that adequate airports will have to be built for this type of cargo operation. If the utmost flexibility is not provided, aviation cannot provide a complete public service. It is in meeting this public demand for flexibility that it would appear that the glider when combined with the extreme flexibility of the air pickup can render its greatest service and can demonstrate the kind of efficiency and flexibility that has heretofore never been dreamed of in any kind of transportation; namely, it could provide express and local service combined in one in such a way that cargo and passengers could be carried over a route on which service is rendered at numerous intermediate points, but where at the same time, each passenger and shipment will receive, in effect, thorough service.

In the short-haul field it is the scheduled speed of the operation and not the speed of the airplane that is of primary importance. For example, nothing is gained in operating an airplane which has a speed of 200 and 300 mph at a given altitude if its speed is sabotaged by frequent stops.

Imagine how ridiculous it would be to take a large high-speed transport plane and attempt to operate it on a short-haul route such as an air pickup route. Imagine making 20 intermediate landings with such a plane on a 300-mile route, with ten minutes' delay for each landing. In a case like that, the flying speed of the airplane, no matter how high, would mean practically nothing as the block-to-block schedule speed would be reduced to the pace of surface transportation.

TABLE 1 EFFECT OF AVERAGE DISTANCE BETWEEN STOPS ON SCHEDULED SPEED

Route mileage	Intermediate stops	Average distance between stops, miles	Elapsed time, hr, min	Scheduled speed, mph
2627	4	525 2/5	17:55	157
1307	4	261 2/5	7:45	149
908	5	151 1/3	6:30	139
570	4	114	5:17	108
519	3	129 3/4	3:37	143
476	2	158 2/3	3:23	140
390	2	130	3:27	111
359	2	119 2/3	3:12	112
359	3	89 3/4	3:36	110
219	2	73	2:00	110
216	2	72	2:01	107

Now that we have more speed in airplanes that can be economically used on the short haul, it is obvious that flexibility must be of foremost consideration. Flexibility means the ability to cut to a minimum delays at intermediate points and the ability to serve points that are close together. This flexibility has been achieved by means of the air pickup.

Reference has been previously made as to how the value of speed in the transport plane is affected in scheduled operations by the length of the route and intermediate stops. From the air lines' schedules published in the Official Aviation Guide, the author has tabulated in Table 1 a number of schedules selected at random which illustrates this point.

A study of these operations, in all of which the aircraft used is a DC-3 which has a normal cruising speed of 180 mph, discloses that on the longest route of 2627 miles having four intermediate stops an average distance of 525 miles apart, the schedule is maintained at an average speed of 157 mph or 87.22 per cent of the cruising speed of the airplane. This differential becomes more pronounced as the routes become shorter and the distance between intermediate stops decreases. On the route of 1307 miles, having the same number of intermediate stops, which are separated by an average distance of 261 miles, the ratio drops to 82.78 per cent, and on the route of 908 miles with five intermediate stops, 151 miles apart, it declines to 77.22 per cent. On the eight remaining routes, all of which are under 600 miles in length and where the over-all average distance between stops is 111 miles, the ratio is 65.56 per cent for the group. Schedules on all air-mail pickup routes are maintained at a speed of 110 mph, or 89 per cent of the 125-mph cruising speed of the single-engine pickup planes.

The eight routes of less than 600 miles provide a cross section of the range in which the flexibility of the glider could probably be most successfully employed in commercial operations. Proceeding on this assumption, let us set up a hypothetical cargo glider operation using a DC-3 airplane as a tug. Our imaginary route, taking round figures for convenience, would be 400 miles long and have three intermediate stops an average distance of 100 miles apart. Applying the speed index of 65.56 per cent which it has been found is the average differential between scheduled speed and the cruising speed of the aircraft on routes of this length, the scheduled speed of an airplane flying alone over this route would be 118 mph.

Now we hitch on the glider or, in this case, it will be a formation of three gliders, one for each intermediate point. Through cargo will be stowed in the tug. The combined capacity of the gliders will be equivalent to the pay-load of the airplane. We will assume that the addition of the gliders will reduce the cruising speed of the tug about 25 per cent as a conservative

estimate, or to 135 mph using a DC-3. This assumes the use of gliders of only moderately clean design with wing loadings that will enable them to land at speeds between 45 and 50 mph. If the gliders were of cleaner design and the landing speeds allowed to run higher the cruising speed of the tug might not be reduced below 145 mph. Using the 135-mph figure, making the flight without landing and dropping gliders off at each intermediate point, we could conservatively assume a block-to-block schedule speed of at least 120 mph, or 89 per cent of the 135 mph. I am conservative, I am sure, on this schedule speed as experience in nonstop pickup operation shows that we can keep schedules at 89 per cent of a lower cruising speed where adverse winds will cause a greater difference between cruising speed and schedule speed. And this does not allow for any accumulated improvement in cruising speed resulting from dropping off the drag of a glider at each intermediate point. If, however, we were to make a landing at each point in order to exchange gliders, I am sure I would be equally conservative in predicting that the schedule speed would be reduced to a figure not higher than 105 mph, which figure can be arrived at by simply subtracting from the previous 120 mph nonstop schedule speed the effect of a 10-min time on the ground at each intermediate point. This time represents the usual schedule allowance for intermediate landings using DC-3 equipment and does not attempt to make allowance for any additional delays that may be caused by handling gliders.

If we consider the problems involved in moving the gliders into take-off position and in attaching each to the tug at each of these intermediate points, it would not be difficult to imagine how the time lost at each point could reduce the block-to-block schedule speed to a point where the value of the service would be completely destroyed. Moreover, the size of the airports necessary to conduct such an operation would certainly confine the service to only the larger cities. It is apparent that a nonstop operation, in which a glider is cut loose at each intermediate point, would be considerably more feasible, but it would be limited by its inability to render service between intermediate points and terminals. The maximum load-carrying ability of the formation could not be utilized over the entire route and the problem of retrieving the gliders and returning them to terminals would still remain. With the application of the air pickup principle, however, our cargo-glider operation begins to assume more practical aspects. The pickup gives it the combination of speed and flexibility which are the primary requirements of short-haul transportation. With respect to the speed factor, it already has been shown that on present air pickup routes the scheduled speed is 89 per cent of the cruising speed of the aircraft. Applying this ratio to the cruising speed of a DC-3 with gliders attached, estimated at 135 mph, we could maintain a scheduled speed of 120 mph over our hypothetical route in a straight pickup operation. This would be at least 15 mph faster than the glider-tow operation previously described, and still 2 mph faster than the average schedule speed now maintained by DC-3's over a route of this sort.

On glider pickup routes where there is more than one intermediate stop, it will be necessary of course to operate glider formations composed of one for each intermediate point. Our hypothetical route would require a tug and three gliders. At each on-route point a glider would be delivered and another picked up which would give these places service both to and from terminals, something that would not be possible otherwise, unless landings were made. Use of more than one glider should not materially affect the schedule speed of the operation. The frequency of pickups causes little or no delay. Experience in air pickup operations to date has shown that pickups can be made at speeds substantially above that of the cruising speed of the airplane, as in tests pickups have been made at ground speeds as high as 150 mph. There appears to be no immediate limit to the speed at which pickups can be made, nor does there appear to be any immediate limit to the size of tug and gliders used for such operations. Furthermore, glider pickup experiments already have demonstrated that little or no more delay is required for a glider pickup than for a mail pickup.

In recent tests, eight consecutive glider pickups were made at intervals of every 4 min using the same glider and the same pickup tug. On air pickup routes, stations are installed as nearly as possible in the line of direct flight, and experience has likewise shown that no deviation from course is necessary even with a downwind component as much as 20 mph. If conditions are encountered where the downwind component is in excess of 20 mph, pickup pilots prefer to make the pickup in the opposite direction "S'ing" through the station. Although the maneuver necessitates a complete reversal in direction and a turn back on course, it is found that the time lost in making it is easily regained while flying between stations through the additional speed supplied by the tail wind component.

One of the outstanding features of the glider for military purposes, and one of the outstanding safety factors in operating motorless craft, is the fact that it can be landed in areas many times smaller than an airplane of equivalent capacity. Through the employment of the air pickup system it can now be retrieved by air from similar areas which ordinarily would make it necessary to dismantle the craft. This advantage means that the size of local airports need not restrict the scope of glider pickup service in scheduled operations as it does not in trunk-line operations. When more efficient tug and glider combinations have been designed and more experience gained in the operation of glider formations or trains, we undoubtedly will find it possible to tow a relatively large number of gliders by a single tug which will still further increase the flexibility of the glider pickup system allowing greater intensification of this type of service.

There are those who believe that glider operations will never be practical commercially because of problems concerned with take-off, rough weather, blind flying, and similar difficulties. This theory reflects the philosophy which for years has been retarding the development of aviation, and I must express complete disagreement with it. With respect to these particular problems, substantial progress has already been made in meeting them. Problems relative to take-off already have been practically eliminated by the adaptation of the air pickup system to launch gliders. The Germans have used rockets for this purpose. Rough-air operations have been practically corrected by the use of special towlines and special shock-absorbing equipment. Problems involved in blind flying are being worked on and have already been practically eliminated through special blind-flight instruments. It is a safe prediction that if a progressively constructive attitude is taken toward the solution of these problems, they will be solved and solved quickly.

While it appears that the glider may have its most important commercial application in the further development of short-haul air transportation, recalling again that the term "short-haul" is purely relative, it must be appreciated that we are entering a new field in aviation which remains to be fully explored. What we learn as we progress may change our whole concept of the future, but regardless of what happens it is essential that we approach this new problem with an open mind. Many things in aviation which are commonplace today were once regarded as the dreams of visionaries.

Never again must we permit an overconservative influence to retard developments in aviation as they have done. Let's develop to the utmost the possibilities that will give aviation what is demanded of it by the public, which is the greatest possible flexibility combined with the ability to carry heavier and bulkier pay loads more efficiently.

ORGANIZATION *as a* PROJECT *in* HUMAN ENGINEERING[1]

By PAUL PIGORS

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THE present time is critical for management. Can it hold its own? It is a critical time for labor too. Will it weaken itself through internal dissension or can it unite to build on the opportunities of the present? Since each group is on the defensive, there is inevitable friction between them in labor relations. Is there any way in which all forces can pull together in a united purpose?

Dynamic administration[2] can resolve this wasteful struggle for power by developing more individual initiative and more group responsibility. It can deepen our understanding of the strength that comes from a constructive interplay between these factors. By working toward power *with* each other, instead of struggling for power *over* each other, we can generate more power for each other and implement our belief in a democratic way of life.

Miss Follett's book is a collection of papers written during the twenties but entirely timely today. The subjects covered include: Constructive conflict, the psychology of power, business management as a profession, the giving of orders, and social planning. A few key ideas permeate all these studies and are illustrated by a wealth of examples from different fields in both America and England.

By farsighted social scientists, Miss Follett received early recognition as an authority in the fields of government and business administration. But she was too far ahead of her time for her ideas to be assimilated by the average businessman and labor leader. The level of thinking in these groups has now reached a point where the questions considered by Miss Follett are of general interest.

In such a vital democracy as ours she recognized the inevitability of friction. But instead of regarding this condition as an obstacle to human achievement she takes the engineer's viewpoint and asks: How can we make friction do something for us? Frank recognition and constructive use of individual difference in regard to a practical problem can lead to revaluation of objectives and integration of desires on a higher level of agreement. Thus dynamic management through a joint study of a difficult situation can marshal its forces for a joint control in which power is generated, not dissipated. Participating individuals waste no time squabbling over words and prejudices but are interested in developing collaborative social techniques. The following case taken out of current industrial life shows how the principles of organization championed by Miss Follett work in actual practice.

The executive of a small plant manufacturing automobile accessories was disturbed by unsatisfactory housekeeping throughout the plant. Negligence on the part of employees resulted in waste, abuse, or loss of materials, machinery, and tools. Workers in their turn complained of dirt, drafts from broken windows, oil-smoke and fumes from inadequately ventilated welding booths, dust from buffing and polishing wheels, and dangerously slippery floors. Current unsatisfactory housekeeping conditions had set up a vicious circle. Management penalized workers for carelessness and refrained from installing improvements, on the ground that "sloppy" workmen would not respect them. The employees countered that management had a "hell-of-a-nerve talking good housekeeping with the plant run ragged like it is."

The chief executive, of course, was aware that the primary responsibility lay in his hands, but was perplexed as to how the vicious circle could be broken. Furthermore, owing to expanding business conditions he had to spend most of his time in the central Detroit office and had little opportunity to devise and supervise an effective housekeeping program. His annoyance with unsatisfactory plant conditions was vented on first-line supervisors who, in turn, merely passed it on with compound interest to the workers below. In these successive clashes the maintenance foreman became the goat. Hampered by inadequate authority and a limited budget he was utterly unable to meet the demands that pressed upon him from all sides.

The alternate absence and return of the chief executive corresponded to phases of dormant irritation and periodic explosions. The net result was no improvement in housekeeping conditions but an excessively high labor turnover.

To break this vicious circle, a consultant in labor relations, aided by a joint fact-finding committee of workers and supervisors, conducted a survey of unsatisfactory housekeeping conditions. They stressed such questions as: (*a*) What are the specific instances of neglect? (*b*) What trouble results? (*c*) What remedies could be suggested? Seventy-eight items were found. Since in the past both workers and first-line supervisors had dodged the issue with the excuse of crowded conditions, these items were analyzed in their relationship to space. In three cases space actually was a major factor and in six other items space might be called a contributing element. This left sixty-nine items of unsatisfactory housekeeping which had to be accounted for in other ways.

On the basis of these data the consultant suggested that management take the initiative in a constructive program of better housekeeping by attacking items which had plant-wide distribution and could be remedied at little cost, e.g., cleaning windows, furnishing adequate cleaning supplies (brooms, waste barrels, etc.), and repairing holes in the floor.

As soon as these suggestions were put into effect they gave positive demonstration of management's good faith and intention to co-operate with the workers in a good housekeeping program. It was then obviously fair to ask the workers to contribute their share in following instructions and submitting suggestions for further improvements.

A joint committee for action (consisting of staff men, foremen and key workers) was set up to analyze and classify all housekeeping conditions that needed attention. The consultant sat in as a participant observer at its first two meetings to

[1] One of a series of reviews of current economic literature affecting engineering prepared by members of the department of economics and social science, Massachusetts Institute of Technology, at the request of the Management Division of The American Society of Mechanical Engineers. Opinions expressed are those of the reviewer.

[2] "Dynamic Administration: The Collected Papers of Mary Parker Follett," edited by Henry C. Metcalf and L. Urwick, Harper & Brothers, New York, N. Y., 1942, 320 pages.

assure the development of a balanced program. At first the committee tended to dwell on remedies which could be pressed on top management as employee "demands." Gradually it learned to match such requests with projects involving more intelligent supervision by foremen and better employee co-operation. The periodic discussions made clear to the workers and subforemen the conditions under which the maintenance foreman had to operate, and this new understanding led to increased authority and respect for him. Furthermore, on the basis of cost analysis, it was easy to demonstrate that the new housekeeping program should be a joint proposition and not just an additional burden on management.

This practical step-by-step approach met with enthusiastic response which transmuted the vicious circle into an upward spiral of mutual confidence and co-operation. It illustrates how, by getting away from generalities and down to cases, joint investigation of facts led to responsible joint control and greatly improved conditions and attitudes. It shows how ***thinking with each other*** can be substituted for ***arguing against each other*** and constructive action can be developed out of a stalemate.

This sort of participation by the workers is far more than mere consent to a management-initiated program. It depends on mutual instead of one-sided activity. It is characteristic of a working unit in which ideas are interactive. To attain such effective group participation, Miss Follett lists three prerequisites:

1 The prevention of an "either–or" situation in which the two parties take up opposite sides and prepare to fight it out. The only possible results of such conflict are victory for one or compromise for both. Either alternative entails waste and disappointment. But joint control through the participation of all members makes effective use of all available resources and helps to create new power and insight.

2 The development of a "cards on the table" attitude by both management and labor, so that frank discussion is possible, instead of a spirit of antagonism and opportunism that conceals facts to obtain an advantageous bargaining position.

3 The ability of management representatives on all levels to "catch differences early and at the work level" before irreconcilable conflict attitudes have time to develop. This means that in training junior executives and supervisors, management should give: (*a*) Detailed information about constructive leadership methods, (*b*) a stimulus to adopt these methods, and (*c*) opportunities to practice them until they become habitual.

Granted the premise that leaders can be trained, what are we working toward? Miss Follett's characterization of a good leader is as follows:

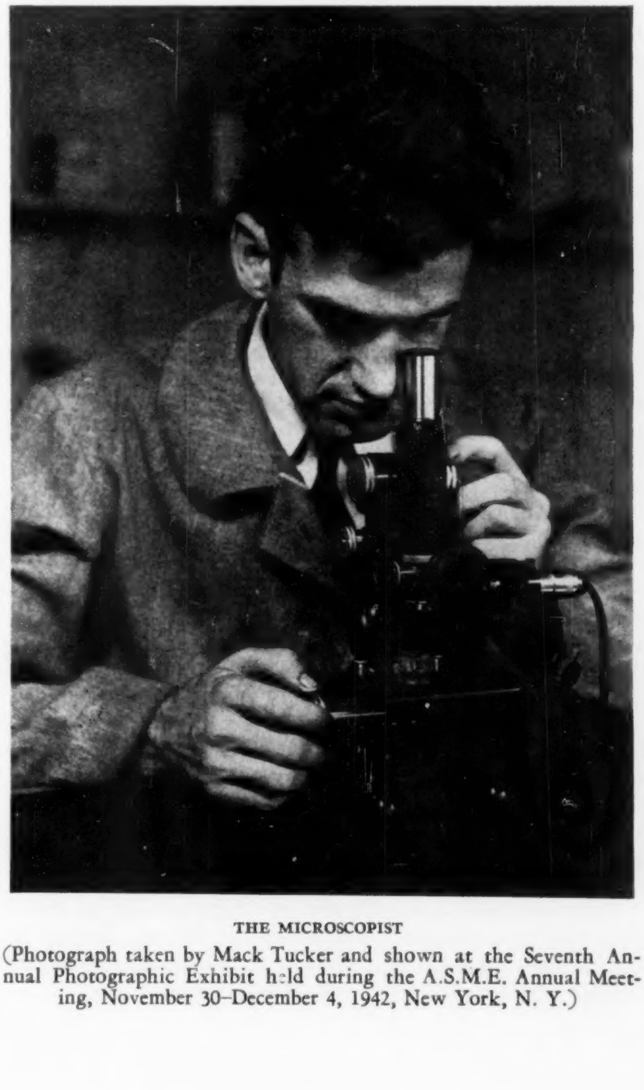
1 He is one who can show that his directives are integral to the situation. How can he be sure that his ideas are keeping pace with the developing situation? He allows the "law of the situation" to guide him by taking a conscious, responsible, and scientific (i.e., objective and experimental) attitude toward experience.

2 He can and does develop power in others. How does the business leader do this? First, by recognizing that managerial ability is much more widely distributed than is ordinarily supposed. No matter what his place in the organization, every man who uses judgment in executing orders and accepts the responsibility involved ***is managing*** to some extent. Second, by bringing out this power wherever it is found and aligning it with the central purpose of the organization. Power is capacity. It cannot be given or taken away. The manager cannot share ***his*** power with his division superintendents, foremen, or workmen, but he can and should give them opportunities for developing ***their*** power. Authority should be redistributed according to function and possibility of growth. There must be careful planning and regulation by policy-making top executives who are capable of carrying out their decisions through systems of management controls. But there must also be individual initiative and opportunity for self-development at the lower levels of a business organization. The proper balance between control and independence can be attained by following the maxim: No freedom without responsibility; no responsibility without authority.

3 A leader is one who can see an experience as a whole and interpret the relational significance of all the parts to the participating members. In working toward more co-ordinated interdepartmental relations, he can show that there is no such thing as a ***purely*** departmental problem. Each member of the organization should feel responsibility for his part of the whole and for the whole too. Such responsibility ***for*** is a higher concept in organizational theory than mere responsibility ***to*** one's immediate superior.

4 He is a person who can see ahead and thus not only predict, but partly guide, the developing situation. Everyone inescapably influences the future by his actions in the present, but only by conscious organization can we influence it according to plan.

While no one can claim to have spoken the last word on these vital questions of organization and leadership, Miss Follett opens up a broad field of fruitful inquiry for those who want to get behind academic abstractions and traditional conceptions to a realistic study of authority, power, and control.



THE MICROSCOPIST

(Photograph taken by Mack Tucker and shown at the Seventh Annual Photographic Exhibit held during the A.S.M.E. Annual Meeting, November 30–December 4, 1942, New York, N. Y.)

To A.S.M.E. Members:

THE COUNCIL REPORTS FOR 1942

OUR own Society has responded invariably to the demands made upon it and taken its share in the rapid dissemination of skills and knowledge required in the period of reorientating the nation's manufactures. In their national organizations and as individuals, the engineers of the country have risen to this new opportunity of service to their people.

"But there is a greater duty to be thought of if this nation is to play a major role in the world after the conflict is over. Our youth are doing their part in battle. We have had very prompt evidence of the soundness of their courage and their utter devotion to our cause. It is of the duty of our older men I am speaking, the duty to keep our hearts stout, to look into the future with intelligent courage and not flinch at the responsibility which will surely be ours of enforcing a world peace." [Extract from address delivered by President James W. Parker at the Semi-Annual Meeting in Cleveland, June 8–10, 1942.—EDITOR.]

THE SOCIETY AND WORLD WAR II

The foregoing quotation is an appropriate keynote for the Society during its year just past and the years of war just ahead.

War came at the close of the 1941 Annual Meeting but before that the Society's activities and plans were of war and the part the Society should play in it. "Defense" had been the keynote. Meetings and publications were concerned with those problems connected with the building of a great industrial structure devoted to production for defense. Our members in the armed forces and in industry were without exception devoting their time and effort to the training in the arts of war or in production of the instruments of defense.

On December 8 the Society turned its attention to war. The increase in the armed forces brought young graduates opportunity for active service for their country and gave those in industry increased opportunity to devote still further energy to the business of producing the engines of transportation and of combat without which no modern struggle can be fought and with which the issue must be settled on the battlefield.

This report gives evidence of the continuing emphasis with which the Society carried on its time-honored function of a professional society to support the efforts of its members in their duty to their country. Meetings of the Society were devoted to the problems of production, of education, of special training for war, of conservation of critical materials, of conversion of peacetime industry to the needs of war. The staff was pressed with requests for help for the small industries, for suggestions of competent personnel for assignment in the armed forces and in the public agencies connected with war. The Society's Defense Committee was converted to a War Production Committee, representation of the Professional Divisions was added, and its program was strengthened to be of even larger assistance in the war effort.

THE PROGRAM OF THE SOCIETY

The Society operates through its 17 professional divisions, 70 local sections, 120 student branches, 18 research committees, 30 standardization committees, 19 power-test code, boiler-code, and safety committees. There are Society representatives on 84 joint committees which co-operate with 31 other societies. There are 16 standing committees and 18 special committees of Council.

The committees have made reports which are digested under three headings, namely, I—Promoting the Art and Science of Mechanical Engineering; II—The Engineering Profession; and III—Administration of the Society.

I—PROMOTING THE ART AND SCIENCE OF MECHANICAL ENGINEERING

MEETINGS AND PROGRAM

In support of the view that the Society had an even greater opportunity for usefulness during war, the decision was made that the national Society meetings be held as usual. Table 1 shows the meetings held, papers presented, and attendance:

TABLE 1 ANALYSIS OF PROGRAMS OF NATIONAL MEETINGS, PROFESSIONAL DIVISIONS

Meetings	Papers and addresses	Authors	Total registered
Society			
Fall, Louisville, Oct. 13–15, 1941	38	57	345
Annual, New York, Dec. 1–5, 1941	108	142	2937
Spring, Houston, Mar. 23–25, 1942	40	50	677
Semi-Annual, Cleveland, June 8–10, 1942	53	54	820
Professional Divisions			
A.S.M.E.-A.I.M.E. Fuels	14	16	350
Hydraulics Conference with Am.Soc.C.E. and S.P.E.E.	17	27	..*
Heat Transfer with A.I.Ch.E.	24	50	..*
Oil and Gas Power with S.A.E.	13	29	471
Applied Mechanics	9	13	91
Total	316	438	5691
Corresponding Totals for 1940–1941	320	391	5633

* Registration not recorded.

It is not possible in this brief space to summarize the results of the meetings in other than general terms. They were devoted largely to the war effort and their success justified the determination to hold them.

PUBLICATIONS

The war effort also placed an increasing load on publications. A comparison of the number of papers published this year with last year shows how the burden has increased due to war-production programs:

	No. papers, 1942	No. papers, 1941
MECHANICAL ENGINEERING	144	111
Transactions	87	77
Journal of Applied Mechanics	36	25
	267	213

There was an increase of 54 papers.

Because many of the papers presented were of immediate application to war production they were printed in MECHANICAL ENGINEERING rather than scheduled for later appearance in Transactions.

The many student branches in operation during the summer months required current numbers of MECHANICAL ENGINEERING.

The rise in the cost of printing and in the cost of paper forced the committee to face economies.

President Parker sent a letter to all members asking that those who were not using Transactions or the *Journal of Applied Mechanics* or both of these publications permit their names to be removed from the mailing lists. This was in the interests of conserving paper. The results were helpful although increased costs of printing and paper absorbed the saving resulting from cancellation of mailing lists.

An export license was necessary in order to send a technical magazine to a foreign country and delays have been experienced in mailing to members outside the United States.

Special editorial service is providing abstracts of a few A.S.M.E. papers for distribution through the Office of War Information and the Department of State.

A new membership list was distributed in February, 1942.

PROFESSIONAL DIVISIONS

The increase of professional work caused by the war effort has resulted in accelerated activities of the professional divisions. It is difficult to compare the work of the different divisions, but mention should be made of the rapid progress of the Aviation Division and the Production Engineering Division as well as the most successful work of the Railroad Division.

Round-table discussions have proved popular and instructions for handling this type of meeting have been made available by the divisions. Four joint meetings with other technical societies have resulted in additional interest and attendance.

Closer contact between individual divisions and the Standing Committee on Professional Divisions has developed increased understanding of mutual problems, through invitation of division representatives to the meetings of the Standing Committee. Also during the term of President Parker, the Standing Committee was invited to sit in and discuss their problems with the Council with the result that a better personal acquaintance now exists.

All divisions have been cognizant of their responsibility in the war effort and their programs have been devoted to bringing this about.

LOCAL SECTIONS

The outstanding developments resulting from the 1941 Group Conferences were:

- To commend many local sections for their support and extension of junior group activities
- To encourage expansion of local technical libraries
- To ask each section's officers to check for completeness those applications for membership emanating from its area
- To endorse the present policies regarding MECHANICAL ENGINEERING and add emphasis on articles of general and news interest
- To encourage the Council to develop a definite junior-guidance program on the union problem
- To develop closer co-operation between local sections, professional divisions, colleges, and national organizations
- To encourage the Council to appoint a committee of national scope to study and expand Past-President W. L. Batt's proposal regarding the problems of the postwar period.

During the year the 70 sections held 517 meetings. Six sections co-operated with other groups in holding production clinics at the request of Donald M. Nelson, chairman of the War Production Board. The success of these meetings and the quality of leadership displayed by the A.S.M.E. Sections in carrying them on are a source of great satisfaction to the Council. Other meetings being planned furnish splendid opportunity to render constructive aid to the war program.

BOARD OF HONORS AND AWARDS

During the year the following honors were awarded at the Annual Meeting in New York:

Honorary Membership	LEON P. ALFORD CLARENCE D. HOWE SAMUEL M. ROBINSON AUREL STODOLA CHARLES M. WESSON
A.S.M.E. Medal	THEODOR VON KÁRMÁN
Holley Medal	JOHN C. GARAND
Worcester Reed Warner Medal	RICHARD V. SOUTHWELL
Melville Medal	ROGER V. TERRY
Pi Tau Sigma Certificate	R. HOSMER NORRIS
Junior Award	JOHN T. RETTALIATA
Charles T. Main Award	JOHN J. BALUN
Undergraduate Student Award	G. WALKER GILMER, 3RD

The Postgraduate Student Award was not presented this year.

The presentation of Honorary Memberships and medals and Pi Tau Sigma Certificate was made at the Annual Dinner; the Charles T. Main Award and the Undergraduate Student Award, at the Council-Student Luncheon.

RELATIONS WITH COLLEGES—STUDENT BRANCHES

The Committee has faced the changing conditions resulting from the war as represented by accelerated college schedules and has revised the rules and regulations for Student Branch operations to permit branches to operate on an academic-year basis rather than a calendar-year basis.

As a means of facilitating contact with the Society during the war period, the Council enacted the following:

A student member will be eligible to apply for transfer to Junior membership upon completion of his college course, or upon actually receiving his degree.

Junior membership cards will be issued to student transfers entering the armed forces upon making a token payment of $2.50 or more, without the privilege of receiving publications.

The status of student transfers entering the armed forces will be frozen for the period of the war emergency.

A regrouping of the branches is being studied with the idea of facilitating travel to group meetings.

Student branches are now operating in 120 colleges and universities in the United States and Canada. During the year 1941–1942 the student membership reached an all-time high total of 7640.

EDUCATION AND TRAINING FOR THE INDUSTRIES

At the 1941 Annual Meeting there were three sessions with six papers. At the Cleveland Meeting there were three sessions. At Rochester the committee arranged for two sessions. National Defense, Co-operative Education, and Training Women for Engineering Jobs were subjects treated.

LIBRARY

The Library and its staff continues to be of great service to engineers. The lighting of the reading room has been much

improved. The cost of borrowing books has been reduced. "Associate Members of the Library Committee" are being appointed by local sections.

RESEARCH

The Research Committee reports an active year in research activity. Of the 19 special projects, 14 reported the usual satisfactory progress which was reflected in the published progress reports and papers read at the Society meetings. The special and joint research committees sponsored six technical sessions at the general meetings of the Society. During the year thirty-one meetings of these technical committees were held in New York and at other cities throughout the country.

The three items of special interest are (1) the initiation of a research on the effects of pulsating flow on the readings of orifice meters; (2) the rapid development of the research on the forging of steel shells; and (3) good progress reported in the preparation of the manuscript of the book on "Strength of Metals," being written by D. J. McAdam, Jr., for the Special Research Committee on Mechanical Springs.

STANDARDIZATION

This year in spite of the national emergency the activity of the Society's Standardization Committee has been satisfactory. Ten standards were completed, approved by the Council, and transmitted to the American Standards Association. This group included the following four new standards:

Air Gaps in Plumbing Systems, A40
Cast-Iron Screwed Drainage Fittings, B16
Steel Socket-Welding Fittings, B16
Threaded Cast-Iron Pipe for Drainage, Vent, and Waste Services, A40

The committee takes satisfaction in reporting the completion of the revision and extension of the 1919 standard for pipe threads.

Four additional standards have reached the approval stage. One is with the sponsor organizations and the other three are out for letter-ballot vote of the initiating committee.

Forty meetings of standards committees were held during the year and twenty-three reports are in the various stages of progress.

Members of the Standardization Committee appeared before the Council in June and pointed out that there is an opportunity for the Society to set up standards which are of a more limited nature and do not need the protection of the proper procedure of the American Standards Association. The Council authorized the committee to initiate such standards and to establish a procedure for their formulation which would be independent of the procedure of the American Standards Association.

POWER TEST CODES

Owing to the present war emergency the individual power test code committees have found it difficult to carry on their work with their customary assiduity. The annual report of the standing committee, however, shows a number of items of general interest to the members of the Society.

The Joint A.I.E.E.-A.S.M.E. Committee on Specifications for Prime Mover Speed Governing held four meetings and has completed a draft of a specification for speed-governing of steam turbines intended to drive a-c generators of not less than 10,000 kw rated capacity.

The committee has endeavored to co-operate with the Subcommittee on Supercharger Compressors of the National Advisory Committee for Aeronautics to the end that the test codes for superchargers developed by the two groups would be essentially alike.

The standing committee reports progress also in the revision of the following test codes and supplementary material: general instructions, definitions and values, fans, internal-combustion engines, and certain sections of information on instruments and apparatus.

SAFETY

Three projects have occupied the principal attention of the A.S.M.E. safety-code committees during the year. These are (1) the supplement to the American Standard Safety Code for Elevators, (2) the completion and the submission of the Safety Code for Cranes, Derricks, and Hoists, and (3) a supplementary report on the development of the Safety Code for Jacks. The first of these is now available in pamphlet form and the last two are still in the hands of the American Standards Association.

BOILER CODE

Much of the work of the Boiler Code Committee has been directed toward meeting the needs of the present national emergency. In order to conserve critical materials, and in the interest of speeding-up the war effort, special rulings have been issued authorizing increased design stresses for Code boilers and Pars. U-68 and U-69 unfired pressure vessels, the use of universal mill plates, and the use of A.S.T.M. emergency specifications that affect Code specifications.

The committee has formulated new rules for the welding of boilers of locomotives and has segregated the Rules for the Standard Qualifications for Welding Procedure and Welding Operators in a new section which is designated as Section IX.

RADIO BROADCASTS ON "THE ENGINEER AT WAR"

The Founder Societies and the American Institute of Chemical Engineers joined in a program of broadcasts on "The Engineer at War." Representatives of each society were selected and a committee formed of which Everett S. Lee of Schenectady was chairman and Prof. F. C. Carvin of Newark College of Engineering was secretary. A program committee was appointed consisting of a representative of each society with Dean R. L. Sackett as chairman.

The series appeared over the N.B.C. network at 6:30 p.m. Thursdays, beginning July 16 and ending September 24.

The subjects were: Blackouts; Incendiary Bombs and Gas; The Resistance of Structures; Navy Ship Construction; Dry Docks; Tanks and Tools; Airplanes; Petroleum and Rubber; Power—Electric, Mechanical, and Steam; The U. S. Engineers Corps in Peace and War; Communications.

Members of the societies and Army and Navy officers were the speakers. Numerous requests for copies of scripts were received. The information given was authentic and, in the case of incendiary bombs, it was the first official endorsement of the now accepted treatment.

CONSULTING PRACTICE

Following several meetings of the committee to discuss the effect of the war on consultants, the committee recommended: A pamphlet, now in preparation, giving opportunities for engineers in government service; and a round-table session at the 1942 Annual Meeting to review and formulate a policy for consulting engineers.

DUES-EXEMPT MEMBERS

Voluntary contributions are made by the "Old Guard," which is composed of those who are exempt from the payment of dues by virtue of 35 years of membership or 30 years if they have reached the age of 70 years.

Such funds are used (1) to award prizes to student members

and (2) to invite them to be guests of the "Old Guard" at dinners during the Annual Meeting and (3) to have as guests, during the Annual Meeting, those who are winners of special prizes. Recipients of these recognitions are duly appreciative.

THE ECONOMIC STATUS OF THE ENGINEER

The committee is studying problems related to professional recognition. It states that professional standing has not been defined, that defense-training programs carried on in or by engineering colleges complicate the problem.

Some who have pursued such short courses may be expected to claim professional standing and the public will be further confused. The committee proposes to make a study of the problem.

THE ENGINEERS' CIVIC RESPONSIBILITIES

The committee feels, in general, that the keeping alive a sense of civic responsibility during the emergency is a great responsibility. The committee has directed all its efforts to the stimulation of interest on the part of student members of the profession. With this idea, for the stimulation of student-branch members, the committee sponsored two contests: The Walter Kidde Award at the Newark College of Engineering for the best essay written on the subject, "The Life of John S. DeHart, Jr.;" and the A. A. Potter Award at Purdue University for the best essay written on the subject "The Engineer During the Present Emergency." The prizes of $50 each were won by Oliver J. D'Amato and Weldon F. Stump, members of the Student Branches of the Newark College of Engineering and Purdue University, respectively.

FREEMAN FUND

No new activities were initiated during the year by the Freeman Fund Committee, but the sales of the publications, "Hydraulic Structures" and "Experiments Upon the Flow of Water in Pipes and Pipe Fittings Performed in 1892 by John R. Freeman" continue very satisfactorily.

INDUSTRIAL CONSERVATION

This committee resulted from the symposium on conservation and salvage in the program for the 1941 Annual Meeting.

Meetings were held at Cleveland and Rochester on salvage. Nine local sections staged conservation and salvage programs. Twenty-three engineering societies joined in a meeting in New York City which 800 persons attended.

The committee has co-operated with the War Production Board and with the National Association of Manufacturers; it has helped other Societies and agencies in the conservation field.

II—THE ENGINEERING PROFESSION

The following section gives a summary of those joint committees and representatives through which this Society co-operates with other scientific and engineering organizations in an attempt to further the development of the engineering profession.

The Council of the Society has traditionally supported a wide variety of movements designed to advance the solidarity and unity of the engineering fraternity.

The war in which we are all engaged calls for maximum effort and effective united action by our profession. The engineer is one of the most important forces engaged in the struggle and every influence should be exerted that sound counsel and organization can contrive.

The need for co-ordination of war activities between the societies was recognized and a Joint Conference of Presidents and Secretaries of the Founder Societies was instituted in October, 1941. Three meetings held resulted in (1) the establishment of a joint committee to support a program of more intimate co-operation with engineers of Latin America and (2) a Joint Committee on Postwar Planning. As the year drew to a close plans were under consideration to set up a body of greater continuity to carry on this co-ordination function and the function of the Engineers' Defense Board which had been established to assist the War Production Board in its program of material conservation.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

The activities of the Engineers' Council for Professional Development are peculiarly essential to the war effort and to postwar reconstruction. Engineering-school curricula have been made uniform through visitation and accrediting; secondary-school boys are receiving counsel and guidance by committees of engineers; a revised booklet "Engineering as a Career" is in increasing demand by schools and students. Closer contacts are promoted with the new graduates and junior engineers in war industries and those in the military forces, with a view toward their further development professionally and preparations for their return to civilian activities.

Toward the close of the year E.C.P.D. was invited to present the problems of engineering and industry to the War Manpower Commission. The result of the presentation was the decision to appoint an engineer to the staff of the Commission and to designate an engineering advisory committee, to be headed by the chairman of E.C.P.D.

Engineers' Council for Professional Development is a conference of three representatives from each of the following participating Societies: A.S.C.E., A.I.M.E., A.S.M.E., A.I.E.E., A.I.Ch.E., S.P.E.E., the National Council of State Boards of Engineering Examiners and, since October, 1941, The Engineering Institute of Canada.

The general objective of E.C.P.D. is the enhancement of the professional status of the engineer. To further this purpose E.C.P.D. recommends from time to time to the governing boards of the participating bodies such actions and procedures as it considers to be of value in promoting the foregoing objective. It administers such procedures as shall have been approved by the respective boards of the participating societies.

Chairman Doherty, president of Carnegie Institute of Technology, in the ninth annual report, said:

> An astonishing number of people, including some comparatively close to the work, have felt that the most important activity and the only significant achievement of E.C.P.D. has been in connection with the accrediting program. Yet the Charter clearly indicates other purposes and activities—relating to selection and guidance, professional training, professional recognition—and these are also actively pursued by standing committees. And from the point of view of further advancement of the profession, and more important still, the welfare of the country, these other purposes and activities are in the long run unquestionably of equal importance with accrediting. Good students are not less essential than good schools.

Reports by the various committees aforementioned are included in the annual report. The Committee on Engineering Schools has over the years accredited 565 curricula in 129 institutions out of 143 institutions which it has examined.

THE ENGINEERING FOUNDATION

During the year 1941–1942, 15 researches sponsored by the Founder Societies were given financial aid. The following research projects which were under A.S.M.E. sponsorship received support:

Effect of Temperature on Properties of Metals
Critical-Pressure Steam Boilers
Rolling Steel. Cold Rolling

Friction of Lubricated Surface at High Pressure
Dynamic Characteristics of Materials
Unsteady Heat Flow Investigations by Electrical Analogy

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The program of Section M, Engineering, at the 107th annual meeting of the Association, held at Dallas, Texas, on December 29, 1941, was as follows:

Address of the retiring vice-president, Dean R. L. Sackett, A.S.M.E., "The Philosophy of Engineering Education;" "The Role of Strategic Minerals in Our National Defense," by John R. Suman; "Aeronautical Engineering," by Dr. M. J. Thompson; "The Oil Reserves of Irak and Iran," by Dr. Everett De Gollyer, A.I.M.E.; "Industry in the Present Emergency," by D. C. Proctor; "Modern Construction of Large Dams," by Ross White, A.S.C.E.; "Research in Electrical Engineering," by James M. Ketch, I.E.S.

Dean W. R. Woolrich, A.S.M.E., was vice-president elect and Dean Frederick M. Feiker, secretary.

At the business meeting, Dean Thorndike Saville, A.S.C.E., New York University, was elected vice-president for the New York meeting in December, 1942, and George A. Stetson, A.S.M.E., editor of MECHANICAL ENGINEERING, was selected as secretary.

NATIONAL BUREAU OF ENGINEERING REGISTRATION

The National Bureau of Engineering Registration is organized to provide a certifying agency to verify the educational and experience records of competent professional engineers and to register those who meet its standards. Some six hundred engineers of outstanding professional ability and achievement are now registered. The Bureau functions under the National Council of State Boards of Engineering Examiners and an Advisory Board composed of representatives of eight national engineering societies.

NATIONAL CONFERENCE ON ENGINEERING POSITIONS

The difficulties faced by the conference in gathering reliable data under emergency, and then war conditions, led to the decision to suspend activities until the return of peace.

NATIONAL RESEARCH COUNCIL, DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH

The offices, now in Washington, permit close co-operation with the National Academy of Sciences and the National Research Council.

A report was published about the South American tour of distinguished research workers from the United States, sponsored by the National Research Council. Interest in this report still continues.

Essential projects of the Highway Research Board have been continued. It has instituted important projects related to moving traffic essential to the war program and those necessary to the maintenance of existing roads.

During the past year airplane brakes have been improved and the efforts of wheel and brake manufacturers have been brought into better co-ordination.

The Industrial Research Institute now has 45 members, 13 having been added during the past year. Papers dealt largely with personnel research effort as influenced by the war.

Material for a broad survey of welding research was gathered with special reference to war needs.

The Committee on Concrete Research is surveying the various problems still unsolved, the best type of research organization, and existing laboratory facilities, and personnel.

Weather Bureau research, advanced mathematics, heat insulation, and electrical insulation are other projects under consideration or being advanced.

UNITED ENGINEERING TRUSTEES

United Engineering Trustees administer the Engineering Foundation, the Library, and the Engineering Societies Building which is the home of the four Founder Societies, the funds for which were the generous gift of Andrew Carnegie.

Three representatives of each society constitute the United Engineering Trustees. They maintain and operate the building and supervise the funds and the endowments which aid in supporting the library and the research of The Engineering Foundation.

The Trustees act as treasurer of the Engineers' Council for Professional Development, of the Engineering Societies Personnel Service, and of certain relief funds.

The building is fully occupied by the Founder Societies and associated engineering organizations and is maintained in excellent condition.

REGISTRATION OF ENGINEERS

Registration of professional engineers is an important factor in the daily practice and the academic and postgraduation training of the engineer. The interest of the Society in registration is in the hands of a committee which urges engineers to support and follow registration to insure uniform requirements, as well as reciprocity, as between states, and to press for able administration with freedom from considerations other than the ultimate good of the public and the engineering profession.

Interest in registration has increased and one more state has been added to those requiring registration making the total now 45.

III—ADMINISTRATION

Under this division are included those matters which deal with the operation of the Society and with the Secretary's office.

MEMBERSHIP

Table 2 shows the status of the membership on September 30, 1942, and the changes as compared with September 30, 1941.

The work of the Committee on Admissions which held 12 regular and 2 special meetings is summarized below:

Applications pending, October 1, 1941	266
Applications received during the fiscal year 1941–1942	2269
Total applications handled during the year 1941–1942	2535
Recommended for membership	2271
Transfers denied	17
Deferred	20
Withdrawn, incomplete and canceled	46
Deceased	2
Applications pending September 30, 1942	179
Total applications handled during the year 1941–1942	2535

The 2271 recommended for membership were divided into the following grades:

Transfers to Fellow	10
Fellows	4
Members	282
Transfers to Member	87
Associates	12
Juniors	212
Transfers from Student Member to Junior Member	1664
Total recommended	2271
Transfers	97
Total new members recommended	1724

TABLE 2 CHANGES IN MEMBERSHIP

(September 30, 1941, to September 30, 1942)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1942	Sept. 30, 1941	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net changes
Honorary Members	25	23	1	4	...	...	...	...	3	5	3	+ 2
Fellows	127	127	8	1	...	...	3		6	9	9	...
Members	8264	8143	73	290	104	9	83	137	117	467	346	+121
Associates	203	200	...	7	2	...	4	...	2	9	6	+ 3
Junior (20)	1053	995	161	23	35	47	28	81	5	219	161	+ 58
Junior (15)	883	789	323	37	13	186	23	70	...	373	279	+ 94
Junior (10)	6058	5437	...	1393	33	324	79	400	2	1426	805	+621
Total membership	16613	15714	566	1755	187	566	220	688	135	2508	1609	+899

MEMBERS IN MILITARY SERVICE

At the close of the year 200 members reported themselves in the armed services.

The Council wishes to support these members in their effort and have arranged to carry any members in the military service on a "Service List" with dues remitted.

The arrangements made to provide continuing contact with the Society for recent engineering graduates have been described elsewhere.

CONSTITUTION AND BY-LAWS

During the year changes were necessary in B6B, Pars. 4 to 11, on Society Representation, due to the disbanding of the American Engineering Council, and to changes in other organizations in which the Society has representation. Accordingly, amendments were recommended and were adopted at the June 7–8, 1942, meeting of the Council in Cleveland.

The Committee also submitted amendments to B15, "Professional Practice," which consisted of the addition of Pars. 2 and 3. These were adopted by the Council at its June meeting. Changes in Article R14 necessitated by the changes in B15 will be recommended to the Council at its meeting in December for action at that time.

Revision of the Constitution, By-Laws, and Rules, corrected to June 16, 1941, was issued as part of the 1942 Membership List and distributed to each member of the Society. It is available also in pamphlet form.

ENGINEERING SOCIETIES PERSONNEL SERVICE

The Service, operated by the Four Founder Societies, opened an additional office in Boston, Mass., thus increasing the number to five including New York, Chicago, Detroit, and San Francisco.

The files contain the records of more than 10,000 engineers.

During the past year an extra burden has been placed on the Service to fill requests received from various governmental departments, commissions, and private industry for engineers to fill responsible positions in America's war program. The Service is proud that it has been able to fill very important positions in several governmental agencies. There are at present over 800 unfilled positions on the books which are open to qualified engineers.

ENGINEERING SOCIETIES PERSONNEL SERVICE RELIEF FUND

The following fund is the residual of moneys raised during the depression for the relief of engineers. The fund was placed in the hands of the Service to administer and it has continued to give help to needy engineers. There are at present four loans outstanding of from \$3 to \$60, totaling \$138. Six loans totaling \$218.05 have been repaid. The total assets of the fund are \$16,512.33.

THE COUNCIL AND EXECUTIVE COMMITTEE

During the year the Council met at New York in December, 1941, and in Cleveland in June, 1942. In addition, representatives of the Council met informally at Houston, Texas, in March and with the Executive Committee at Rochester in October, 1942.

The Executive Committee held 10 meetings during the year. In order to bring the work of the standing committees closer to the Council, at seven of the meetings, respectively, one of each of the following standing committees was present and discussed its objectives and plans:

Meetings and Program
Professional Divisions
Publications
Education and Training for the Industries
Research
Standardization
Local Sections.

The President visited 16 local sections, 12 student branches. In addition there were visits to the sections and branches by other members of the Council.

FINANCES

During the 1941 Annual Meeting the Society received a gift of \$500 from John Knickerbacker, a member since 1891, and an anonymous gift of \$1000.

The complete report of the Finance Committee follows this report.

OFFICE OPERATION

The public rooms in the Society office were completely redecorated and now provide a most attractive setting for the meetings of the Council and Society committees.

Julian W. Shields has been added to the staff as secretary of the Boiler Code Committee.

The arrangement made with the secretary, Colonel C. E. Davies, and the assistant editor, Major Leslie F. Zsuffa, for the fiscal year ending September 30, 1941, was continued during the current fiscal year. Colonel Davies is on active duty in the Office of the Chief of Ordnance in Washington and Major Zsuffa is on duty in the Transportation Corps.

COMMITTEE REPORTS

The full reports of the committees of the society and of its representatives on joint agencies are embodied in a pamphlet of 54 pages which is available for distribution upon request.

DEATHS

W. H. Winterrowd, newly elected vice-president of the Society, died on December 7, 1941, as a result of an automobile accident. Among other members who died during the year were Past-Presidents Alex Dow (also an Honorary Member), and John Lyle Harrington; Honorary Members L. P. Alford (also former member of the Council), and Lorenzo Allievi; and E. L. Ohle, F. H. Dorner, W. Lyle Dudley, and H. G. Reist, former members of the Council.

A.S.M.E. FINANCE COMMITTEE REPORT, 1941-1942

THE Society has again lived within its income after moderate additions to surplus and to reserve for employees' retirement fund. Our security holdings, as a whole, have maintained their market value. We have continued our policy of conservative valuation of assets of all kinds so that the financial statements may be accepted at face value.

The year has been marked by the conscious adoption of a long-time policy with respect to the Society's surplus, as to its purpose, its ultimate size, and the size of the annual appropriation required to attain this objective, as well as principles governing its investment.

There is a considerable body of opinion among the membership holding that the Society should follow a spend-as-you-go policy. The principal reasons for this attitude, which is understandable, are that surplus has, in the past, not always been invested advantageously and that there have been other sizable drains on accumulated funds. This the Finance Committee hopes to see minimized in the future.

Much time and thought have been given to the economic status of the engineer. The spasmodic manner in which the country's expansion progresses makes the profession particularly vulnerable to recurring waves of unemployment with corresponding effects upon Society income from dues as well as from other sources. Formal engineering education is sadly lacking in failing to provide adequate emphasis on this feature with the result that the engineer is like the general mass of people in his tendency to project existing trends in business and finance far into the future instead of realizing that a boom in business is as abnormal as the depth of depression, i.e., he thinks in tangents instead of in cycles.

It may be that we have here a field which may well have greater attention in Society proceedings but the immediate effect is that in planning the Society's activities, we must either make financial provision for wide fluctuations in income, or be prepared to accept slashing reductions in service to members and in the personnel making up our staff, at recurring intervals. The Finance Committee feels that we should follow an intermediate course. To do this we must lay aside some of our income when it is rolling in freely. There is no other opportunity to do so.

The aim is to be prepared to cushion the impact on Society activities of the decline in income of the next recession in business. The tendency in a period like the present is to increase expenditure unduly as income rises. Experience has shown that income may drop suddenly as much as half. The effect of such a decline on operations and on service to members would be disastrous. On the other hand, it is not feasible to maintain expenditure through a depression at the peak rate.

The plan is to set aside funds sufficient to permit us to make up out of surplus half the anticipated drop over a three-year period. We already have over half the amount considered necessary and, by spreading the remainder over three to five years, we need set aside only a small percentage of annual gross income to accumulate the remainder.

As to the investment of this surplus, the policy is to confine ourselves to media which will not depreciate unduly in a time of general financial distress such as usually characterizes a period of business readjustment. For this purpose we have already acquired substantial amounts of government bonds. Certain investments not meeting the foregoing criterion are to be liquidated and the funds reinvested. Substantial progress has already been made in this direction.

The effort has been to give the financial side of the Society's operations the sort of thoughtful, forward-looking, and prudent consideration that any careful financier would want to see applied to an enterprise in which he has a stake.

The usual operating summary is attached as Exhibits A to E, inclusive.

Respectfully submitted,

K. W. Jappe, *Chairman*	J. L. Kopf
G. L. Knight, *Vice-Chairman*	E. B. Ricketts } *Council*
E. J. Grimmett	W. G. Christy } *Representatives*
J. J. Swan	W. D. Ennis, *Treasurer*

Operating Summary

- A Balance Sheet. Accountants' Certificate
- B Comparative summary of income and expense
- C Statement of surplus
- D Statement of changes in funds
- E Detailed cost of activities
- F How the A.S.M.E. spent its 1941–1942 income

BALANCE SHEET—EXHIBIT A

The Balance Sheet, Exhibit A, of September 30, 1942, shows, on that date, that the Society owed:

(1)	Current bills	$ 365.95
(2)	Obligations for printing and distributing the 1943 Mechanical Catalog, bills for which have not been submitted	19,059.38
(3)	Other obligations for which bills have not been submitted	6,117.50
(4)	Unexpended appropriations for future services	17,520.57
(5)	Special research and other committees which have collected funds for special purposes to be expended as needed	34,170.93
(6)	Future services to members who have prepaid their dues	77,406.32
(7)	Advertisers and subscribers to publications who have prepaid	4,007.90
		$158,648.55

To meet these debts the Society had:

(1)	Cash in the bank	$ 73,386.55
(2)	Accounts receivable	60,683.47
(3)	Inventories of publications and supplies conservatively valued at	23,137.31
(4)	Securities (at the lower of cost or approximate quoted market values):	240,938.32
(5)	Prepaid insurance of	259.73
		$398,405.38

The difference between the value held by the Society of \$398,405.38 and debts of \$158,648.55 is the net worth of the Society on September 30, 1942		\$239,756.83

The Society had other liabilities:

(1) Trust funds amounting to		\$108,851.77
against which the Society had the following assets:		
(a) Cash	\$ 20,911.77	
(b) Notes receivable	3,372.48	
(c) Securities (at the lower of cost or approximate quoted market values):	84,567.52	
	\$108,851.77	
(2) Property fund of		\$528,790.37
with the following assets to support it:		
(a) Quarter interest in building	\$498,448.48	
(b) Office furniture and fixtures (depreciated value)	30,339.89	
(c) Library books	1.00	
(d) Engineering Index, Inc.—Title and good will	1.00	
	\$528,790.37	
(3) Employees' retirement fund of		\$ 45,769.42
covered by:		
Cash	\$ 16,420.92	
Securities (at approximate quoted market value)	29,348.50	
	\$45,769.42	
(4) Rotative project fund of		\$ 4,913.40
Cash	\$ 4,913.40	

The total of the Society's Investment and Trust Fund Portfolios is \$366,636.20, of which approximately $24^1/_2$ per cent is Lawyers Mortgage Company certificates and wholly owned mortgages, the cost of which as shown in last year's report was \$249,401.42 and with an appraised value of \$139,183.99. Redemptions and sales during the year have reduced the cost value to \$158,855.79. The present appraised market value is \$89,-887.16. The cash income received during the year from these Lawyers mortgages and certificates was \$7,635.93. Average yields on these real-estate mortgages and certificates were:

	Trust Fund Assets	Society Investments	Aggregate
Based on Cost	4.39	6.00	5.28
Based on Market	8.25	10.40	9.48

The Security Portfolio was enlarged during the year by the purchase of high-grade preferred stocks totaling \$12,215.09, railroad bonds \$4,583.76, and U. S. Government Bonds totaling \$138,765.13.

INCOME AND EXPENSE—EXHIBIT B

The total income received during the year 1941–1942 was \$42,045.74 more than that received during the year 1940–1941. The membership dues received were higher by \$2,587.84 and revenues from MECHANICAL ENGINEERING advertising and Mechanical Catalog advertising were \$46,332.69 more than received during 1940–1941. Revenue from publication sales was lower by \$6,493.39.

SURPLUS—EXHIBIT C

Net Addition to Surplus for the year 1941–1942 is \$32,215.77 or \$2,374.04 more than last year.

ACCOUNTANT'S CERTIFICATE

To COUNCIL OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

We have examined the balance sheet of The American Society of Mechanical Engineers as at September 30, 1942, and the summary of income and expenses and statements of surplus and changes in funds for the fiscal year ending that date. In connection therewith, we reviewed the system of internal accounting control and the accounting procedures of the Society and, without making a detailed audit of the transactions, have examined or tested accounting records of the Society and other supporting evidence, by methods and to the extent we deemed appropriate. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances and included all procedures which we considered necessary.

In accordance with the practice followed by the Society in prior years, no effect has been given in the statements to accrued income on investments.

The membership dues are included in the income account of the current year on the basis of total cash received on account of that year and prior years and provision has been made for a dues uncollected at September 30, 1942.

In our opinion, with the foregoing explanations, the accompanying balance sheet and related summary of income and expenses and statements of surplus and changes in funds present fairly the position of The American Society of Mechanical Engineers at September 30, 1942, and the results of its operations for the fiscal year, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year except that, in accordance with a resolution of the Executive Committee of the Council, a reserve has been provided for mortgage investments of the General Fund which has reduced the carrying value of these securities below their approximate quoted market value at September 30, 1942.

(Signed) PRICE, WATERHOUSE & CO.

New York, N. Y.
November 2, 1942

EXHIBIT A

BALANCE SHEET—SEPTEMBER 30, 1942

ASSETS

GENERAL FUND:			
Cash in banks and on hand			$ 73,386.55
Accounts receivable:			
Dues—current year	$16,525.53		
Dues—prior years	810.03		
	$17,335.56		
Less—Reserve	17,335.56	.....	
Publications and advertising	$62,299.59		
Less—Reserve	2,577.99		
		$ 59,721.60	
Miscellaneous		961.87	60,683.47
Inventories, at cost or less:			
Publications completed		$ 9,734.45	
Publications in process		12,173.42	
		$ 21,907.87	
Less—Reserve		3,552.52	
		$ 18,355.35	
Supplies		4,781.96	23,137.31
Securities:			
Real estate mortgage bonds and certificates (cost $88,874.15)	$47,690.17		
Less—Reserve provided from net profit on sales and portion of interest income	11,781.86	$ 35,908.31	
Railroad and industrial stocks and bonds (at the lower of cost or approximate quoted market values)		49,263.38	
United States Government bonds (at cost)		155,766.63	240,938.32
Prepaid insurance			259.73
			$ 398,405.38
ROTATIVE PROJECT FUND:			
Cash in bank			4,913.40
EMPLOYEES' RETIREMENT FUND:			
Cash in banks		$ 16,420.92	
Real estate mortgage bond (at approximate quoted market value)		9,350.00	
United States Government bonds (at cost)		19,998.50	45,769.42
TRUST FUNDS:			
Cash in banks		$ 20,911.77	
Notes receivable (Major Toltz Fund)		3,372.48	
Securities (at the lower of cost or approximate quoted market values):			
Stocks and bonds	$50,190.53		
Real estate mortgage certificates	34,376.99	84,567.52	108,851.77
PROPERTY FUND:			
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of Trust Funds		$498,448.48	
Office furniture and fixtures (depreciated value)		30,339.89	
Library books		1.00	
Engineering Index, Inc.—Title and good will		1.00	528,790.37
			$1,086,730.34

LIABILITIES

GENERAL FUND:		
Accounts payable		$ 365.95
Accrued liabilities and reserves:		
Estimated liability relating to Mechanical Catalog for 1942–1943	$19,059.38	
Other accrued liabilities (estimated)	6,117.50	
Reserves for unexpended appropriations	17,520.57	42,697.45
Unexpended balances of Custodian Funds		34,170.93
Deferred credits:		
Dues and initiation fees paid in advance	$77,406.32	
Prepaid subscriptions (estimated)	4,000.00	
Prepaid advertising	7.90	81,414.22
Surplus (Exhibit C)		239,756.83
		$ 398,405.38
ROTATIVE PROJECT FUND (Exhibit D)		4,913.40
EMPLOYEES' RETIREMENT FUND (Exhibit D)		45,769.42
TRUST FUNDS, including unexpended income (Exhibit D)		108,851.77
PROPERTY FUND		528,790.37
		$1,086,730.34

NOTE: Initiation and promotion fees receivable are not included in the above statement as they are taken up by the Society only as and when collected.

EXHIBIT B

COMPARATIVE SUMMARY OF INCOME, EXPENSES, AND APPROPRIATIONS

For the Two Years Ending September 30, 1942

	Year 1941–1942	Year 1940–1941
INCOME:		
Initiation and promotion fees (to surplus)	$ 11,565.35	$ 9,837.57
Membership dues*	$232,626.70	$230,038.86
Student dues	24,998.85	21,088.00
Interest and discount (net)	9,955.95	10,534.05
MECHANICAL ENGINEERING advertising	127,741.52	90,741.69
Mechanical Catalog advertising	57,062.86	47,730.00
Publication sales	74,016.63	80,510.02
Miscellaneous sales	2,601.06	2,096.95
Contributions—*Journal of Applied Mechanics*	1,100.00	1,200.00
Engineering Index, Inc.	.....	495.27
Registration fees	698.00	426.00
Sale of equipment	104.50	96.00
Membership-list advertising	603.00	.....
TOTAL INCOME	$531,509.07	$484,956.84
EXPENSES AND APPROPRIATIONS:		
Expenses under committee supervision (including appropriation of $10,000 to Employees' Retirement Fund in 1941–1942 and $20,000 in 1940–1941)	$ 90,197.24	$ 94,280.08
Publication expense	168,653.15	159,306.63
Office expense	244,980.23	212,014.07
Appropriation to reserve for mortgage investments—interest on mortgages and mortgage certificates in excess of 3% on the book value thereof	4,506.49	.....
TOTAL EXPENSES AND APPROPRIATIONS:	$508,337.11	$465,600.78
Excess of income over expenses and appropriations for the year	$ 23,171.96	$ 19,356.06

* Membership dues have been stated on the basis of total cash received during the year.

EXHIBIT C

STATEMENT OF SURPLUS

Year Ending September 30, 1942

BALANCE, SEPTEMBER 30, 1941		$207,541.06
ADD:		
Initiation and promotion fees collected		11,565.35*
Excess of income over expenses and appropriations for the year (Exhibit B)		23,171.96
Collections on Parker case judgment		849.30
Net profit on sale of investments:		
Bonds	$ 501.14	
Real estate mortgage certificates	6,182.17	
	$6,683.31	
Less—Appropriation to reserve for mortgage investments	6,182.17**	501.14
Distributions on mortgage guarantee claims	$1,093.20	
Less—Appropriation to reserve for mortgage investments	1,093.20**	.....
		$243,628.81
DEDUCT:		
Adjustment of carrying value of bonds and stocks owned to the lower of cost or approximate quoted market value at September 30, 1942		3,871.98**
BALANCE, SEPTEMBER 30, 1942		$239,756.83

* As it is the practice of the Society to take up initiation and promotion fees only as and when collected, the above statement does not include such fees receivable at September 30, 1942.

** The value at which the investments of the General Fund are carried is $59,089.93 below cost and $14,844.42 below their approximate aggregate quoted market value at September 30, 1942.

THE "SENTINEL," BUILT BY THE STINSON DIVISION OF VULTEE AIRCRAFT, INC.

(This small, rugged, highly maneuverable new plane is designed to be the "eyes upstairs" of the artillery, tank corps, cavalry, and infantry. Carrying a pilot and an observer and packed with radio equipment, it can hover and maintain altitude at an exceptionally low speed while directing artillery fire or the movements of tanks or troops below. It is a veritable "flying jeep" which can cover almost any kind of terrain, is designed to go wherever the ground troops go, to get in and out of a cow pasture, or to plunk itself down on a highway.)

EXHIBIT D

STATEMENT OF CHANGES IN FUNDS

Year Ending September 30, 1942

ROTATIVE PROJECT FUND

Transfers from Trust Funds	$ 3,403.40
Outstanding certificate of indebtedness and accrued interest thereon received as a gift from member	510.00
Cash contribution	1,000.00
BALANCE, SEPTEMBER 30, 1942	$ 4,913.40

* * * * *

EMPLOYEES' RETIREMENT FUND

BALANCE, SEPTEMBER 30, 1941	$ 35,089.30
Add:	
Income from investments	653.64
Interest on savings bank deposits	26.48
Appropriation from General Fund	10,000.00
BALANCE, SEPTEMBER 30, 1942	$ 45,769.42

* * * * *

TRUST FUNDS

BALANCE, SEPTEMBER 30, 1941		$113,538.27
Add:		
Income from investments		5,260.73
Interest on notes receivable		134.02
Interest on savings bank deposits		51.63
Life memberships purchased		1,510.92
Profit on sale of investments		95.81
		$120,591.38
Deduct:		
Expenditures for prize awards, book distribution, etc.	$2,578.98	
Proportion of life membership dues transferred to General Fund income	590.00	
Transfers to Rotative Project Fund	3,403.40	
Investment custodian fees	31.78	
Adjustment (net) of carrying value of bonds and stocks owned to the lower of cost or approximate quoted market value at September 30, 1942	5,135.45*	
		11,739.61
BALANCE, SEPTEMBER 30, 1942		$108,851.77

* After giving effect to this adjustment, the carrying value of the Trust Fund securities is $39,444.21 below cost.

EXHIBIT E

DETAILED COST OF A.S.M.E ACTIVITIES 1941-1942

Description	Expense under committee supervision	Printing and distribution expense	Office expense	Total cost 1941-42	Total cost 1940-41
Council	$ 4,600.00			$ 4,600.00	$ 5,203.84
Library	9,356.88			9,356.88	9,265.40
American Engineering Council					2,075.00
Engineers' Council for Professional Development	1,950.00			1,950.00	2,045.01
Finance Committee	108.00			108.00	110.00
Awards	743.91		$ 453.98	1,197.89	1,072.18
Nominating Committee	432.15			432.15	698.82
Local Sections	26,831.42		6,448.57	33,279.99	29,723.66
Meetings and Program	7,431.00		6,977.02	14,408.02	12,929.77
Professional Divisions	5,707.94		7,807.82	13,515.76	10,932.22
Admissions			7,696.38	7,696.38	8,380.47
Employment Service	2,000.00			2,000.00	2,631.09
Student Branches	12,936.04		4,683.21	17,619.25	21,152.78
Technical Committee	1,000.00		21,439.68	22,439.68	21,336.31
MECHANICAL ENGINEERING Text Pages		$ 37,123.92	10,613.40	47,737.32	36,071.06
Transactions and *Journal of Applied Mechanics*	105.69	36,263.22	13,322.91	49,691.82	48,400.96
Membership List		3,511.85		3,511.85	6,091.00
MECHANICAL ENGINEERING Advertising Pages		33,434.15	32,830.45	66,264.60	48,622.80
A.S.M.E. Mechanical Catalog		25,900.00	23,870.62	49,770.62	42,438.56
Publications for Sale		32,420.01	9,084.41	41,504.42	50,722.56
Retirement Fund	12,700.00			12,700.00	22,700.00
Professional Services	1,248.50			1,248.50	1,123.50
Membership Development	3,000.00			3,000.00	2,500.00
Organization Charts	45.71			45.71	50.00
Secretary's Office			20,116.67	20,116.67	16,374.30
Accounting			15,853.84	15,853.84	14,680.19
General Service			35,968.65	35,968.65	27,348.26
General Office			27,812.62	27,812.62	20,921.04
	$90,197.24	$168,653.15	$244,980.23	$503,830.62*	$465,600.78

* Does not include $4,506.49 (Exhibit B) as on the Society's books it is charged directly against "Interest and Discount" income.

How the A.S.M.E. Spent Its Income in 1941-1942

EXHIBIT F

Dues Income: $232,626.70—$14.00 per Member.

The principal item of income is the dues paid by the members. Juniors pay $10, $15, or $20 depending upon their age; Members pay $20, Fellows, $25, except that those who have been on the rolls of the Society for 35 years or who have reached 70 and have been members 30 years are carried without dues. On September 30 the Society had 16,613 members on its rolls and during the year $232,626.70 was collected in dues. The per-member dues income is therefore $14.00.

The publications of the Society are MECHANICAL ENGINEERING, Transactions, including the *Journal of Applied Mechanics*, the Membership List, and the A.S.M.E. Mechanical Catalog and Directory. Income is obtained from advertising in MECHANICAL ENGINEERING and in the Catalog. Contributions have been received for the *Journal of Applied Mechanics*. An income and expense statement for the publications appears below:

PUBLICATIONS

	Direct expense	Income
MECHANICAL ENGINEERING	$114,001.92	$127,741.52[a]
Transactions (including *Journal of Applied Mechanics* and Membership List)	53,203.67	1,703.00
A.S.M.E. Mechanical Catalog	49,770.62	57,062.86
Publications sold	41,504.42	74,016.63
	$258,480.63	$260,524.01
Indirect expense	55,578.24	
	$314,058.87	
Less income	260,524.01	
Net cost of publications	$ 53,534.86	
Total expense of publications per member	18.90	
Publications income per member	15.68	
Net expense per member	$ 3.22	

[a] No allowance is included for what might be considered as A.S.M.E. member subscription to MECHANICAL ENGINEERING or Transactions. The net expense of $3.22 may be regarded as the amount of these subscriptions.

Technical Committee Work: Net Expense $27,861.51—$1.68 per Member.

The Society has nearly two hundred technical committees engaged in the work on research, establishing power test codes, preparing the boiler code, and preparing standards and safety codes. The work of these committees is supported by direct staff expense which in 1941–1942 was $22,439.68. Adding to it indirect general expense of $5,421.83 gives a total expense of $27,861.51, which on a per-member basis is $1.68. The principal output of the technical committees is publications which are sold to members and to others. This figure of expense should therefore be considered in relation to the publication expense of the Society.

General Society Activities: Net Expense $81,538.11—$4.91 per Member.

The general activities of the Society include the holding of meetings, the operation of Local Sections, Professional Divisions, Student Branches, the administration of the procedure for admitting members to the Society, and the bestowal of awards. The Society receives income from Students for their membership in the Society. The following tabulation shows the net expense for this activity.

GENERAL SOCIETY ACTIVITY EXPENSES

	Direct expense	Income
Society Meetings	$ 14,408.02	$ 698.00
Local Sections	33,279.99	
Professional Divisions	13,515.76	
Student Branches	17,619.25	24,998.85
Admissions	7,696.38	
Awards	1,197.89	
	$87,717.29	$25,696.85
Indirect expense	19,517.67	
	$107,234.96	
Less income	25,696.85	
Net cost of general Society activities	$ 81,538.11	
Total expense of general Society activities per member	6.45	
Income per member	1.54	
Net expense per member	$ 4.91	

Joint Activities: Net Expense $23,098.42—$1.39 per Member.

The Society also participates in a number of joint activities such as the Library, Engineers' Council for Professional Development, and the joint Employment Service. In addition to the payments to these joint bodies for these purposes a certain amount of general expense is allocated to these activities. The following tabulation gives the total of this expense.

JOINT ACTIVITIES

	Direct expense
Engineers' Council for Professional Development	$ 1,950.00
Engineering Societies Library	9,356.88
Employment Service	2,000.00
	$13,306.88
Indirect expense	9,791.54
Total cost of joint activities	$23,098.42
Expense per member	$1.39

Administration: Net Expense $23,421.84—$1.41 per Member.

In carrying out the Society activities certain administrative services must be provided. These include the expense of the Council, the Nominating Committee, and the provision for auditing, legal, and other services. Certain general income is received. The following tabulation shows the amount of this expense and income.

GENERAL SOCIETY ADMINISTRATION

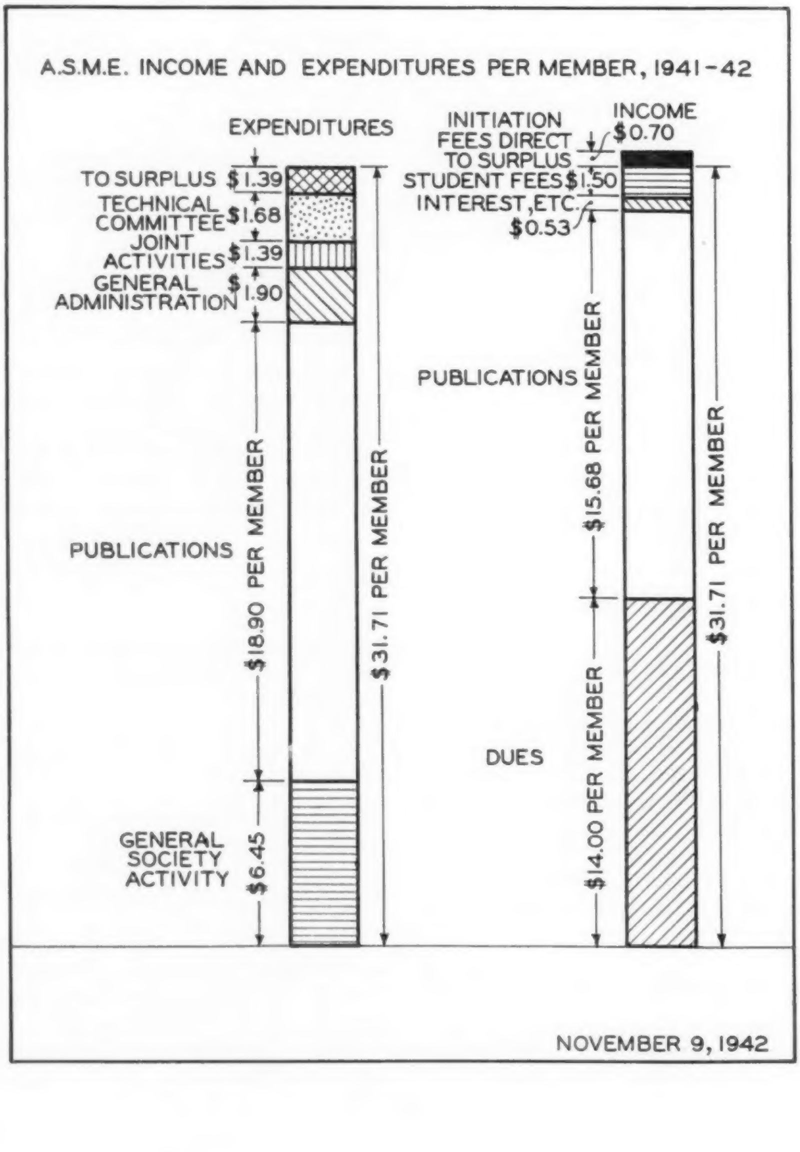
	Direct expense
Council	$ 4,600.00
Nominating Committee	432.15
Retirement Fund	12,700.00
Professional Services	1,248.50
Finance Committee	108.00
Membership Development	3,000.00
Organization Charts	45.71
	$22,134.36
Indirect expense	9,442.50
	$31,576.86
Income from interest and miscellaneous	8,155.02
Net cost of general Society administration	$23,421.84
Expense per member	1.90
Income per member	.49
Net expense per member	$ 1.41

RECAPITULATION

	Expenses	Income
Dues	$	$232,626.70
Publications	314,058.87	260,524.01
General Society Activity	107,234.96	25,696.85
Technical Committee Work	27,861.51	....
General Society Administration	31,576.86	8,155.02
Joint Activities	23,098.42	....
	$503,830.62	$527,002.58
Addition to surplus from operating income	23,171.96	
	$527,002.58	

INCOME AND EXPENSE PER MEMBER

	Expense per member	Income per member	Net expense per member
Dues	....	$14.00	...
Publications	$18.90	15.68	$3.22
Technical Committee	1.68	....	1.68
General Society Activity	6.45	1.54	4.91
Joint Activities	1.39	....	1.39
General Society Administration	1.90	.49	1.41
	$30.32	$31.71	
Addition to surplus from operating income	1.39		
	$31.71		



1942 A.S.M.E. ANNUAL MEETING

Largest and Most Diversified A.S.M.E. Annual Meeting Ever Held Concentrates on War Production and Manpower

WITH an accent on war-production problems and war manpower, the 63rd Annual Meeting of The American Society of Mechanical Engineers came to a close on Friday, December 4, after five days of technical sessions that comprised the longest and most varied program ever offered by the Society. Even the facilities of the Hotel Astor, where the meeting was held because not enough space could be found at the Engineering Societies Building, were severely taxed by a record attendance in excess of 3000.

The five major luncheons which were held throughout the meeting were oversubscribed and the Annual Dinner, held on Wednesday evening, had to be limited to 1400. Wherever space was available meetings of committees were being held throughout the week, some of which took the form of special dinners and luncheons.

War conditions seriously handicapped the efforts of the Committee on Plant Trips in organizing excursions to local points of interest. On Thursday afternoon, however, an inspection of some of the departments of the Wright Aeronautical Corporation was enjoyed by a large group of engineers.

The program for women visitors was successfully carried off as usual. Entries in the annual photographic exhibit were much fewer than in past years, but a few examples of the excellent work displayed will be found in this issue.

Strictly Society affairs were discussed at meetings of the Executive Committee of the Council on Sunday morning, November 29; of the Council on Sunday, Monday, and Friday; and of the Group Delegates Conference, whose deliberations began on Sunday morning. The Annual Business Meeting was held on Monday afternoon.

SIKORSKY SPEAKS ON INGENUITY

Public sessions of the 63rd Annual Meeting began with a luncheon on ingenuity on Monday noon. This luncheon, at which President James W. Parker presided, served as a prelude to two sessions sponsored by the Committee on Education and Training for the Industries which followed in the afternoon and evening. As explained by A. R. Stevenson, Jr., chairman of the Committee, the object of the series of sessions was to organize a public discussion of creative engineering, inventiveness, and intuition which engineers were beginning to recognize as an important subject. During the past couple of decades the engineering colleges have been doing a constantly improving job of training analytical engineers for industry. However, many engineers are beginning to wonder if the artistic creative aspect of engineering education is being neglected. The program devised by the Committee was given right of way, by order of the Council, and scheduled for Monday afternoon when no other technical sessions would interfere with a full attendance.

In order to initiate the discussion and arouse interest in the subject, Igor I. Sikorsky, manager-director of Vought-Sikorsky Aircraft, Stratford, Conn., was chosen as the principal speaker. As an introduction to his address, Mr. Sikorsky showed colored moving pictures of his recent helicopter and explained the astounding characteristics of the machine as they were demonstrated by the pictures. The development of the helicopter is an impressive example of the exercise of the creative genius and intuition of the engineer as it is a pioneering venture in a type of aircraft, with commercial possibilities, that can rise vertically, hover, move in any direction at the will of the operator, and land on any surface large enough to provide clearance for the extremities of the machine. Although the conventional type of airplane has been so exhaustively studied that well established engineering data are available to designers, the helicopter must be designed without benefit of experience or, in some cases, knowledge of the principles involved. Hence the development of a practical machine demanded of the designers not only a familiarity with well-known engineering principles but also real creative genius and intuition.

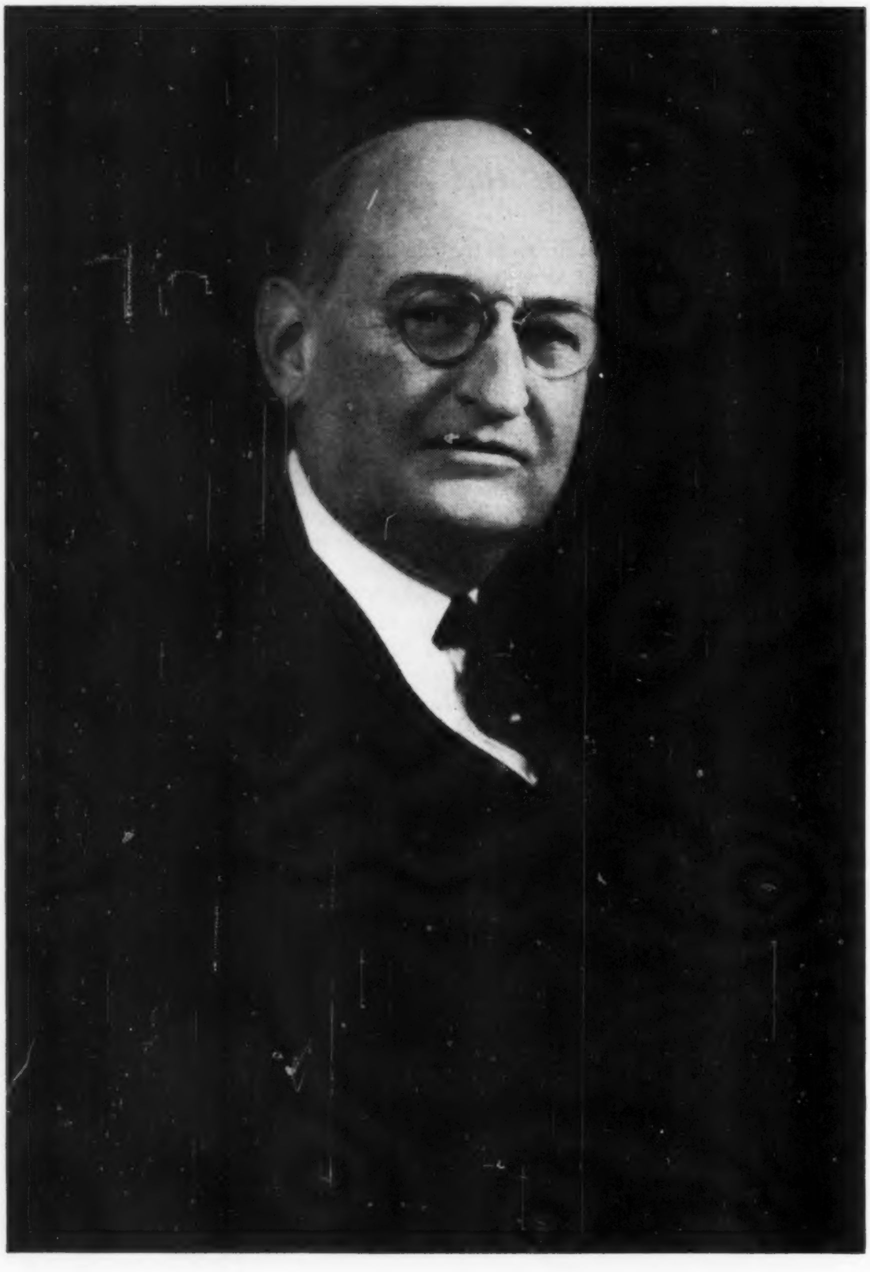
In a delightful address on "Creative Engineering, Inventiveness, and Ingenuity" which followed the showing of the film, Mr. Sikorsky set forth his own opinions in respect to these qualities, and, at some points, appeared to be bordering on the grounds of the metaphysical, if such a term may be applied to processes which do not appear to be in accordance with well recognized natural laws. Four speakers, A. R. Cullimore, president, Newark College of Engineering, C. I. Barnard, president, New Jersey Bell Telephone Co., Newark, N. J., Lawrence Langner, secretary, Inventors Council, New York, N. Y., and K. K. Paluev, transformer division, General Electric Company, Pittsfield, Mass., supported Mr. Sikorsky's address with able discussions of the inventive faculties and nonlogical processes of thought.

On Monday evening the subject was discussed again from the point of view of what can be done to discover and encourage orginality, initiative, and resourcefulness in young Americans. Alonzo D. Grace, Commissioner of Education of the State of Connecticut, spoke on public vocational schools and creative ability. What the engineering colleges can do was explained by Paul B. Eaton, professor of mechanical engineering, Lafayette College, Easton, Pa., and what the local sections can do was outlined by James N. Landis, chairman A.S.M.E. Committee on Local Sections. Industry's role in the task of discovery and encouragement of young men with inventive qualities was discussed by W. E. Johnson, General Electric Company, Lynn, Mass., and by K. K. Paluev, who had spoken at the afternoon session. Finally, to round out the program, A. A. Potter, dean of engineering, Purdue University, presented a paper, "Pride of America," in which he showed how the American patent system had operated to encourage invention and protect the rights of inventors.

It is hoped that the addresses and discussions of the two sessions will be published in an early issue of MECHANICAL ENGINEERING, in view of the fact that they not only excited the interest of engineers who heard them but also were the subject of comment in the press and on the radio.

MANAGEMENT LUNCHEON MEMORIAL TO L. P. ALFORD

Tuesday's luncheon was sponsored by the A.S.M.E. Management Division and was a memorial to the late Leon Pratt Alford, "dean of management editors," who had prepared and edited the Division's reports in 1912, 1922, and 1932, now known as "Ten Years' Progress in Management." It had been Mr. Alford's earnest desire to prepare and edit the fourth report covering the period 1932–1942 and he had started work on it



Harold Vinton Coes

President of
The American Society
of
Mechanical Engineers
for 1943

just before his death. The executive committee of the Division therefore took up the task and resolved that the 1942 report would not only accomplish what Mr. Alford had planned but that the report prepared would also serve as a memorial to him. The task was divided among more than a dozen leaders in management thought who prepared the individual sections of the report, under the guidance of a committee headed by Mrs. L. M. Gilbreth. These were brought together and edited by George E. Hagemann, whose services were appropriately recognized at the luncheon.

John R. Bangs, chairman of the Management Division, presided at the luncheon, at which Mrs. Alford was an honored guest. In opening the session which followed the luncheon Mr. Bangs spoke as follows:

J. R. BANGS EULOGIZES L. P. ALFORD

We are gathered here today to honor the memory of Leon Pratt Alford. We are gathered here today to dedicate a memorial to him—Leon Pratt Alford—able engineer, dean of management editors and historians, developer of men.

It has been said that men are like trees. They differ from each other in similar ways. Some men are like the willow, constantly moving in every direction; some like the sycamore, bending gracefully to every breeze; others like the beech, always smooth on the outside, yet invariably of poor fiber within; while there are still others that are like the oak, sturdy, stouthearted, bristling with strength in every direction and standing foursquare to every wind that blows.[1]

Like the oak was Leon Pratt Alford. Sturdy, stouthearted, he stood foursquare; one of the outstanding figures of the management movement. He knew intimately the great pioneers of management—Taylor, Gantt, Gilbreth. Perhaps even more important in his capacity of editor, he learned to evaluate at firsthand the great body of literature that grew and developed as the years rolled by.

With vision and foresight, he not only recorded the management movement, but with the imagination of a true researcher, he constantly sought to discover new principles and operating techniques.

[1] Willard Beahan in introducing Ambrose Swasey.

James W. Parker

Retiring President of The American Society of Mechanical Engineers for 1942

These he applied in his academic life as well as in his duties as a professional engineer. For example, when I asked him how, in the course of his very busy life, he had time to write his most excellent book, "Principles of Industrial Management for Engineers," he told me that he merely applied management principles.

"When I developed 'Management's Handbook,' " he said, "I scheduled the various chapters on a Gantt chart. When I conceived the idea of writing "Principles of Industrial Management for Engineers," I likewise applied the principle of the Gantt chart. I knew I had available only Saturday afternoons. Consequently, I scheduled at least one chapter each Saturday afternoon and had my secretary come to my home where I proceeded to dictate the chapter. Each Saturday when she returned, she had the material typewritten. We would then develop a new chapter and I would take the transcribed chapter and edit it during the week. In that way, you see, it became a comparatively simple task."

"L. P." was constantly seeking ways for improving harmonious relations in industrial organizations; of developing the various cross-relationships and other types of co-operation that did not appear on the organization chart. He believed in the tying-in of the new labor groups that had developed in recent years. He recognized, as few people did, that "management is the correlation of the operating details of an enterprise so that it will work together as a harmonious whole."

It is not surprising, therefore, that we find Leon Pratt Alford, in 1912, as secretary of a Subcommittee on Administration of the Society, developing a report entitled, "The Present State of the Art of Industrial Management." With the publication of this paper, he conceived the idea of reporting management's progress every ten years. In 1922, therefore, we find him presenting to the Society his first Ten Years' Progress Report. In 1932, he repeated his performance, and, had he lived, he would without doubt have presented the 1942 Ten Years' Progress Report to you here today. However, he was called on January 2, 1942, to perform a greater task.

With his customary careful preplanning and his invariable foresight in discerning the outstanding developments, he had already begun to collect pamphlets, papers, articles, and data on subjects which he considered significant indicators of progress in management. Close friends of Doctor Alford on the Management Division committee felt that no more important step could be taken and nothing more pleasing to Doctor Alford could be done than to continue the practice of presenting a Ten Years' Progress Report on Management at the 1942 Annual

GROUP ATTENDING THE MEETING ON MONDAY EVENING ON "ORIGINALITY IN YOUNG AMERICANS"

Meeting along the sound lines for which he had already set an outstanding precedent. The plan, in fact, became the guiding consideration in selecting topics and speakers for all the Management sessions at the Annual Meeting, thus unifying the program around the most significant management thinking of the day. After the most severe depression ever experienced, which had not ended when the most destructive and widespread war in all history engulfed the entire globe, the preparation of a progress report on management became a problem of major difficulty.

But the Ten Year Progress Report has been completed. By whom? By the Management Committee as a whole, by a co-operative enterprise that is typical of what management stands for.

Briefly, the procedure was as follows. Dr. Gilbreth, at my request, very graciously accepted the chairmanship of the committee to develop the report. Dr. Gilbreth's vision, foresight, and operating knowledge of this field needs no elaboration. She was a "natural" for the job and she has delivered in thoroughbred style. As an example of her organizing ability, she selected as her right-hand man George Hagemann, a seasoned editor, schooled under Dr. Alford. Mr. Hagemann contributed generously of his time and effort to make this undertaking a success.

While major credit is due to Dr. Gilbreth for her splendid direction of this work, she herself insists it is the product of the committee as a whole. I do feel, however, that special acknowledgment is due to J. M. Juran, Lawrence A. Appley, Andrew I. Peterson, E. H. Hempel, Carlos de Zafra, John A. Willard, A. R. Stevenson, Jr., and our most reliable secretary, Gideon M. Varga. Major credit in directing the activities of the Executive Committee in the absence of its chairman and of spurring on the various members to complete their tasks on time is due to our energetic vice-chairman, James Talbot.

H. V. COES PRESENTS PROGRESS REPORT

To Harold V. Coes, president-elect of the A.S.M.E., fell the task of presenting the report, "Ten Years' Progress in Management." The report, which will appear in the A.S.M.E. Transactions, had been preprinted and copies were distributed. Mr. Coes said:

It is with a deep source of personal satisfaction that I stand here to dedicate the third Ten Years' Management Progress Report to Dr. Leon Pratt Alford, the man who, through his wisdom and foresight, initiated these reports to the Society and wrote the first two. Except for his absence from our midst now he would have written the third one which I shall shortly present to the President of the Society.

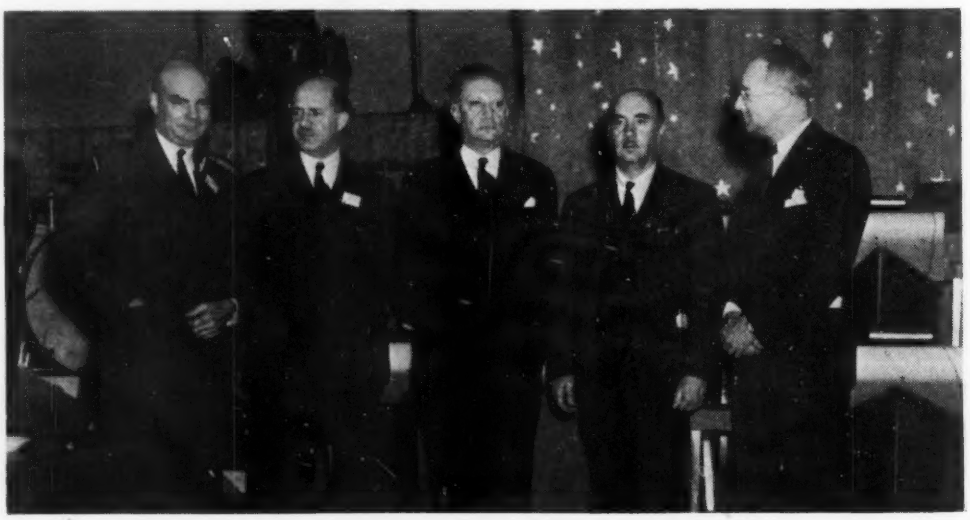
Dr. Alford was an old and valued friend, a man whom I much admired, respected, and loved. I first became acquainted with him when he was editor of the *American Machinist* and I was only a few years out of college. Through the years, I worked with him in one capacity or another on committees of the Society, the American Management Association, the Institute of Management, the American Engineering Council, the Gantt Medal Board, or as author for some of his publications or sections of his "Management Handbook," or the "Cost and Production Handbook," books that ultimately became standard world-wide reference books.

His paper on the "Laws of Manufacturing Management" is a classic and rightly won for him the Melville Medal of this Society. He made numerous contributions to the publications of the Society over a wide range of subjects, the bulk of which, however, were related directly or indirectly to the science and art of management, the subject in which he was most interested. He made numerous real contributions to the literature of management.

It is quite fitting that this third management progress report should be dedicated to Dr. Alford and in this Society, because it was from the platform of this Society that Dr. Frederick Winslow Taylor enunciated, in the first decade of this century, the principles of scientific management. This Society was thus the first organized association to recognize the vital significance of this new field of industrial and economic endeavor.

In 1912 a committee of the Society, of which Dr. Alford was secretary, submitted a report on the "Present State of the Art of Industrial Management."

A study of this first report reveals to those familiar with Dr. Alford's

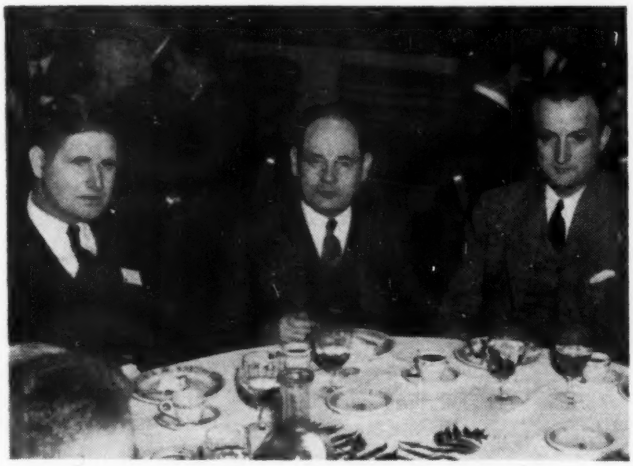


AT INGENUITY LUNCHEON ON MONDAY AFTERNOON

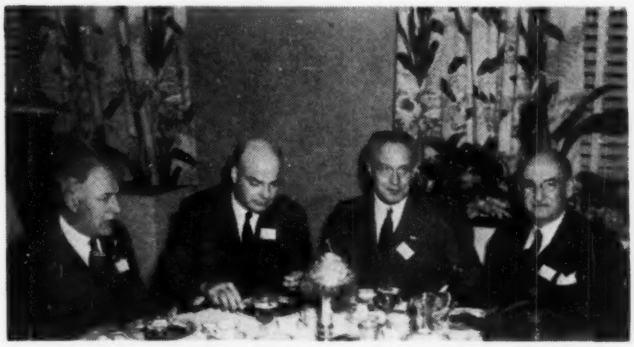
(Left to right: President James W. Parker, A. R. Stevenson, Jr., A. R. Cullimore, Igor I. Sikorsky, and K. K. Paluev.)

MANAGEMENT LUNCHEON, TUESDAY
(S. B. Ely and R. L. Sackett.)

MANAGEMENT LUNCHEON, TUESDAY
(Ray M. Matson, George A. Stetson, and Col. C. E. Davies.)



MANAGEMENT LUNCHEON, TUESDAY
(L. B. Keeler, L. C. Morrow, J. E. Walters.)



MANAGEMENT LUNCHEON, TUESDAY
(Left to right: James M. Talbot, Jr., James W. Parker, John R. Bangs, and Harold V. Coes.)

MANAGEMENT LUNCHEON, TUESDAY
(Left to right: Mrs. G. E. Hagemann, Dr. Lillian M. Gilbreth, Mrs. H. V. Coes, Mrs. R. V. Wright, Mrs. Wallace Clark, Mrs. J. M. Juran, Mrs. P. E. Frank, Mrs. G. M. Varga, Mrs. D. B. Porter.)

progressiveness at this early date his clear conception and prophetic foresight of many of the vast opportunities ahead in applying scientific management principles intelligently to bring about engineering, industrial, economic, and social progress.

It was in 1922 that Dr. Alford conceived the idea of preparing for the Annual Meeting of this Society a Ten Years' Progress in Management Report, to summarize the widespread developments made since the first report on industrial management in 1912. He was particularly interested in doing this because in 1920 the Management Division was formed. I remember discussing certain phases of this idea about a report with him.

When we look about us now and realize that management is the coordinating and directing force that is making it possible for men, material, and machines to achieve the present gigantic production volume of matériel for the war effort, we must appreciate the debt our country owes to these pioneers in the field of management.

Nowhere in the world is it possible to produce under the terrific stress and strain of war such stupendous quantities of manufactured and fabricated technical products.

Never before in the history of mass production, of which this country is the originator, has management been free and unfettered, by economics or market limitations, to test out what unlimited mass production can accomplish. Now the world is beholding what to it is a miracle, but not to us who knew the management background and principles upon which this all-out production program was based.

All honor to those pioneers in management principles and techniques that have made this miracle possible—a miracle, gentlemen, that will save this country, yes, save the world from the dark-age forces seeking to destroy modern civilization and the American way of life.

It is timely to have such a report on management progress, because never in our history has management been under such terrific pressure, such stress or such strain. Management needs all the constructive help it can secure to do an even better job. It is the Society's hope that this report will prove highly beneficial.

Mr. President, I have, sir, the honor and privilege of presenting to you this third Ten Years' Progress in Management report, dedicated to the memory of the founder of these valuable reports, Dr. Leon Pratt Alford.

Following Mr. Coes' address, the chairman called upon James W. Parker, president of the Society, who spoke briefly and extemporaneously, but with great feeling. He called attention to the handicap under which the nation labors because of government mismanagement, and he contrasted the "efficient organization of private management" with "the ineptness of government management." "When the next national crisis comes," he said, "be it a war or a depression, I am not at all sure America can go into it with such handicaps and come through successfully."

STUDENT-MEMBER—COUNCIL LUNCHEON

At a joint luncheon of student members of the Society attending the Annual Meeting and members of the A.S.M.E. Council, Alton C. Chick, chairman of the Committee on Relations With Colleges, presided. Seated with Mr. Chick at the speaker's table were Harte Cooke, chairman of the "Old Guard" through whose generosity many students are permitted to attend sessions of the Annual Meeting; Enrique F. Silgado, Calvin W. Rice Scholar from South America; Russell G. Warner, of the American Institute of Electrical Engineers; L. F. Chen, president of the Chinese Institute of Engineers, America Branch; Col. C. E. Davies, secretary A.S.M.E.; Brig. Gen. Julian S. Hatcher, chief, Military Training Branch, Ordnance Department, U. S. Army; L. Austin Wright, secretary, The Engineering Institute of Canada; and D. S. Jacobus and W. A. Hanley, past-presidents of the Society. In addition, winner of the Undergraduate Student Award, J. Packard Laird, of Princeton University, junior engineer, Carl L. Norden, Inc., New York, N. Y.; winner of the Postgraduate Student Award, Arthur W. McClure, of Princeton University, junior engineer, Turbo Engineering Corp., Trenton, N. J.; winner of the Chas. T. Main Award, Bernard J. Isabella, of the Case School of Applied Science, project engineer, Fuel Pump Production Division, Thompson Products, Inc., Cleveland, Ohio; and winner of the Pi Tau Sigma Award Certificate, John T. Rettaliata, assistant engineer, Allis-Chalmers Mfg. Co., Milwaukee, Wis., were at the table.

In his brief remarks President Parker said that engineering students, in so far as his own observations were concerned, were very much the same wherever he had met them and that they reacted in much the same way as engineering students had done in his own undergraduate days. There was great inspiration to be derived, he declared, by attending annual meetings of the Society. Engineers attended these meetings, he assured the student members, because they valued highly what they got out of them and because they were interested in the young men who were entering the profession.

Mr. Coes, president-elect of the Society, spoke briefly of the advantages of membership in a national engineering society. One got out of such a society in proportion to what he put into it, he declared. Opportunity to make contacts and friends, to attend meetings and discuss technical papers, and to serve on committees were some ways in which the engineering-society member benefited. For the younger member, there were abundant opportunities for ultimate service. He spoke also of the importance of the A.S.M.E. Management Division's work, and of the interest of the older members in the young engineer.

Following the presentation of the awards, John T. Rettaliata, the Pi Tau Sigma medalist, gave an illustrated lecture on the combustion gas turbine.

RAILROAD MANPOWER LUNCHEON

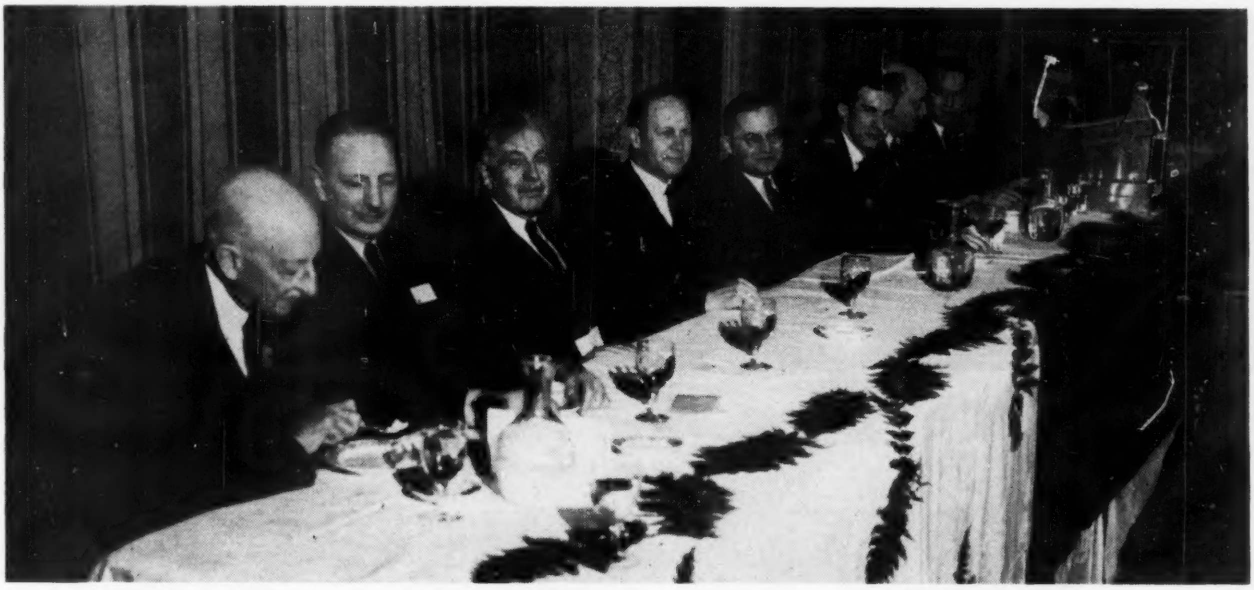
On Thursday noon, between its two sessions devoted to discussions of railroad manpower, the A.S.M.E. Railroad Division held a subscription luncheon at which the Hon. Paul V. McNutt, of the War Manpower Commission, was the guest of honor. Adjournment was taken promptly at 2 p.m. in order to assemble for the afternoon session at which Miss Dorothy Sells, assistant chief, Personnel Section, Office of Defense Transportation, spoke from London through courtesy of the British Broadcasting Commission. D. S. Ellis, chief mechanical officer, Chesapeake & Ohio Ry., Cleveland, Ohio, presided at both morning and afternoon sessions. Among the speakers at the two sessions were F. K. Mitchell, assistant general superintendent of Motive Power and Rolling Stock, New York Central System; Otto S. Beyer, chief, Personnel Section, Office of Defense Transporation; Col. James L. Walsh, chairman, War Production Committee, A.S.M.E.; Harold V. Coes, president-elect A.S.M.E.; A. A. Potter, dean of engineering, Purdue University; Charles E. Brinley, president, Baldwin Locomotive Works; and Brig. Gen. Julian S. Hatcher, chief, Military Training Branch, Ordnance Department, U. S. Army.

Miss Sells told of the accomplishments of woman labor in England, which she had observed during her visit there. There were more than 100,000 women working for the British railways and in other forms of transportation, she said.

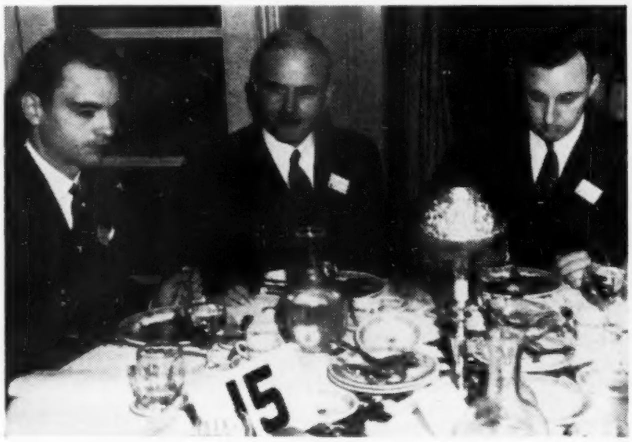
MCNUTT ADDRESSES RAILROAD SESSION

Mr. McNutt said that in addition to those already employed there was a need for 3,000,000 more workers in war industry. "This does not take into account those who joined the armed forces or must be replaced because of death and disability," he declared. "We have emphasized that those workers can be found." Continuing, he said:

"There are certain actions that can be taken that will actually add to the total supply of available labor as we have known it.



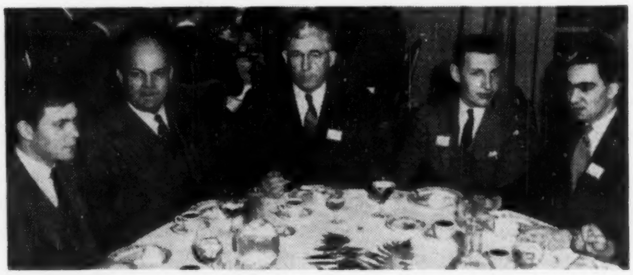
STUDENT-MEMBER—COUNCIL LUNCHEON, WEDNESDAY
(Left to right: Past-President D. S. Jacobus, Austin L. Wright, Harte Cooke, R. G. Warner, Howard E. Degler, J. T. Rettaliata, James W. Parker, Alton C. Chick.)



STUDENT-MEMBER—COUNCIL LUNCHEON
(Left to right: F. Lucke, A. C. Harper, and Robert O'Connell.)

STUDENT-MEMBER—COUNCIL LUNCHEON
(Left to right: Eugene W. O'Brien, B. D. Graves, and R. Winchel.)

STUDENT-MEMBER—COUNCIL LUNCHEON
(Left to right: James W. Partington, John P. Neff, and J. W. Burley.)

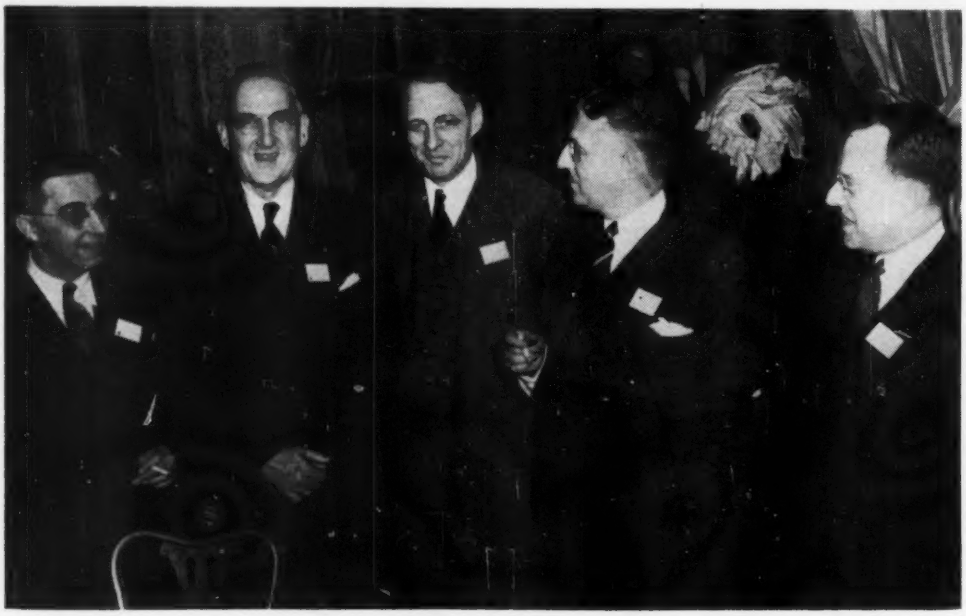


STUDENT-MEMBER—COUNCIL LUNCHEON
(Left to right: D. S. Brady, L. W. Wallace, S. B. Earle, H. Frank, and H. R. Petruzzo.)

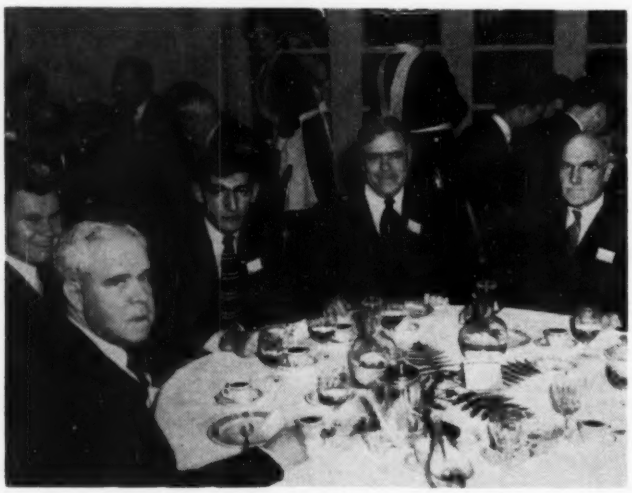
PRESIDENT PARKER PRESENTS THE CHARLES T. MAIN AWARD TO BERNARD J. ISABELLA, CASE SCHOOL OF APPLIED SCIENCE

PRESIDENT PARKER PRESENTS THE POST-GRADUATE STUDENT AWARD TO ARTHUR W. MC CLURE OF PRINCETON

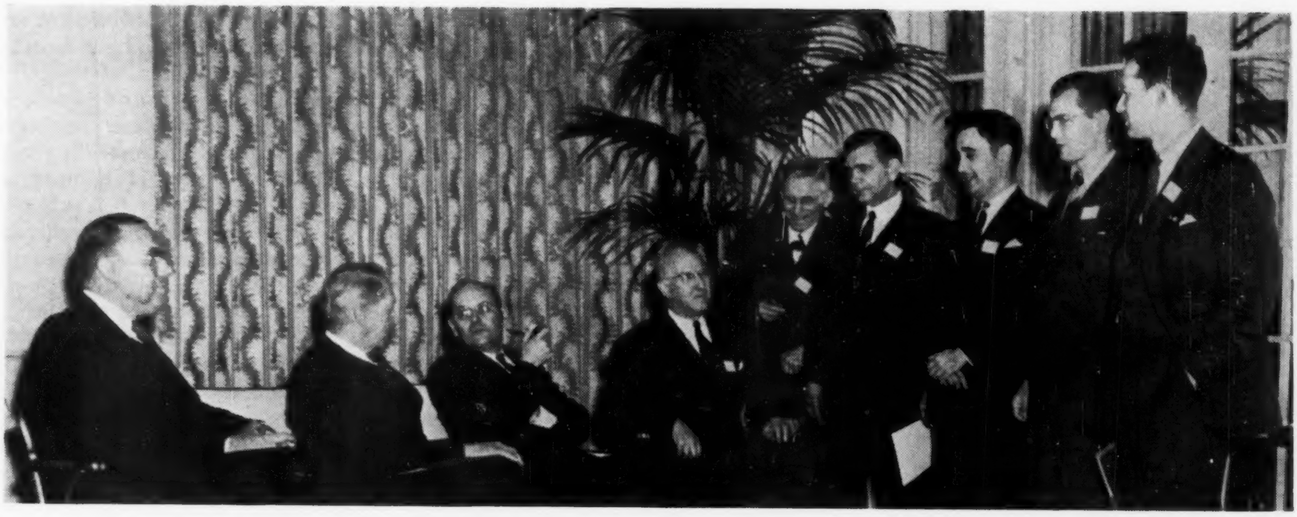
PRESIDENT PARKER PRESENTS THE UNDER-GRADUATE AWARD TO J. PACKARD LAIRD OF PRINCETON



STUDENT-MEMBER—COUNCIL LUNCHEON, WEDNESDAY
(Left to right: H. O. Croft, H. L. Seward, A. Wilson, K. M. Irwin, and A. C. Chick.)



STUDENT-MEMBER—COUNCIL LUNCHEON
(Left to right: A. E. White, W. R. Owens, Jr., L. Vaghubian, R. B. Dale, E. R. Fish.)



AT PRODUCTION ENGINEERING DIVISION MEETING, TUESDAY EVENING

(Left to right: O. W. Boston, J. Allen Harlan, John J. Alden, A. M. Johnson, Arthur Murray, Erik Oberg, A. M. Lennie, W. W. Gilbert, C. L. Tutt, Jr.)

INDUSTRIAL CONSERVATION MEETING, TUESDAY EVENING

(Left to right: R. D. Bullard, C. F. Williams, A. M. Perrin, R. A. Wheeler, F. P. Peters.)

LUBRICATION MEETING, TUESDAY AFTERNOON

(G. B. Karelitz, E. L. Cowan, E. A. Ryder, R. S. Pigott, B. F. Hunter, Walter Claypoole, R. W. Flynn, and C. M. Larson.)

TECHNICAL COMMITTEE NUMBER 2 ON TOOL-POSTS AND TOOL SHANKS MEETS

(Seated, left to right: F. W. Lucht, Granger Davenport, C. G. Williams, O. W. Boston; standing, left to right: F. S. Walters, C. D. Carter, W. C. Mueller, E. J. Bryant, E. M. Martellotti, and W. J. Johnson.)

RAILROAD LUNCHEON
(Left to right: John R. Bangs, Walter Kidde, Victor Wichum, and William M. Sheehan.)

RAILROAD LUNCHEON
(Left to right: H. L. Hamilton, C. C. Bailey, P. R. Turner, and C. B. Peck.)

RAILROAD LUNCHEON
(Left to right: H. V. Coes, President, A.S.M.E., 1943, Paul V. McNutt, Harrison Hoblitzelle.)

"Two years ago there were less than 500,000 women in war production. Today there are nearly four million. And before the end of next year there will be six million.

"Women, as British experience has proved, can do 80 per cent of all war jobs. They can perform many operations better than men. Little by little, reluctance to hire women is giving way to a realization that here, of all things, is the unappreciated sex.

"This matter of using women is one which the railroads should recognize bluntly and act upon now. Proportionately the railroads do not hire enough women—only about 3 per cent of your employees are women as contrasted to some 21 per cent in air transport.

"This unwillingness to use women is not based entirely upon the nature of the railroad industry. There are many railroad offices which still insist upon male stenographers, male telegraphers, male operators for many machines which are entirely within the physical capabilities of women workers. The Pennsylvania Railroad has taken the lead in opening new jobs to women. That program should be stepped up and other railroads should follow that lead.

"Railroads in past years have sometimes built up impressive health and accident records by maintaining physical standards for employment that would have been the envy of the Marines. Such hiring practices cannot continue. Every worker must be used for what he has—not disqualified for his limitations. Age in itself must no longer be a barrier to employment. I advise every railroad employer to study his own rules and to find out how far he can adjust his requirements to increase his available supply of labor.

"Prejudice and discrimination which limit the use of Negroes must go down. By direct negotiation with employers and unions we have greatly reduced discrimination against Negroes and other minority groups. There are more Negroes employed today—both absolutely and proportionately—than ever before in our history.

"And here again railroad management and railroad labor must join in analyzing the hiring practices and the employment traditions of their industry. Were the employment practices of many railroads to be applied to American industry as a whole, millions of American Negroes, instead of turning out the ships, shells and planes and guns America needs for victory, would be immobilized for the duration of the war.

"There are countless other people whose other responsibilities do not permit them to find full-time employment in war industry but who can be used part time.

"All these steps are part of definite programs blueprinted by the War Manpower Commission and applied in many communities and industries throughout the nation. In terms of old standards they actually add to the available labor supply."

In addition to women and Negroes, Mr. McNutt said, the railroads must devise means to employ part-time workers.

"The railroads must remember," he added, "that in addition to filling jobs which are now open, they must plan for replacements. For their men will continue to be withdrawn for the armed services. Deferment is not exemption."

MANPOWER PROBLEMS AT ENGINEERING LEVEL

Dealing solely and specifically with problems of manpower at the engineering level, a panel of engineers and administrators, under the leadership of Harvey N. Davis, past-president A.S.M.E., and president, Stevens Institute of Technology, assembled following a luncheon on Friday noon to participate in the closing session of the 1942 A.S.M.E. Annual Meeting.

The panel consisted of the following:

Joseph W. Barker, special assistant to the Secretary of the Navy, and dean, Faculty of Engineering, Columbia University.

George R. Brown, superintendent of manufacturing engineering, Western Electric Company, Kearny, N. J.

Edward Charles Elliott, chief, Professional and Technical Employment and Training Division, Office for Emergency Management, War Manpower Commission, and president, Purdue University.

Leonard J. Fletcher, director of training, Caterpillar Tractor Company, Peoria, Ill.

L. Austin Wright, deputy director, National Selective Service, Ottawa, Canada, and secretary, The Engineering Institute of Canada.

Philip B. Taylor, vice-president, Wright Aeronautical Corporation, Paterson, N. J.

Robert West, consultant to the Secretary of War.

In conducting the panel, Dr. Davis addressed each member in turn and asked that the problem be discussed in terms of the number of men, trained in engineering, needed for the services and for industry. A stenographic report of the panel discussion was made but time was lacking to secure from each participant authority to quote the comments made.

Following the eight-minute comments of each panel speaker, Dr. Davis addressed a few questions to them and thus initiated a discussion among them to which members of the audience contributed with questions and comments. It is hoped that a more complete account of the discussion will be available for publication at a later date.

Just before closing the session, Dr. Davis read the resolution which the Council of the A.S.M.E. had passed that morning and had sent to the President and the Hon. Paul V. McNutt. The resolution follows:

WHEREAS, technically trained engineers are indispensable to modern mechanized warfare and are needed in greater and greater numbers by the armed forces and by the war industries and will be equally essential to the rehabilitation program,

Therefore, Be It Resolved that the Council of The American Society of Mechanical Engineers, acting on behalf of the membership of the Society, at the Sixty-Third Annual Meeting of the Society held in New York, November 30th to December 4th, 1942, is convinced that the effective prosecution of the war effort demands that an adequate supply of engineers be insured for the armed forces and the war industries through the deferment of certain students in engineering colleges under the following conditions:

1 Enrollment in a college with a curriculum professionally accredited by the Engineers' Council for Professional Development.

2 Completion of not less than one term or one semester's work in an accredited professional curriculum in engineering with an average scholastic grade at least equal to that required for graduation.

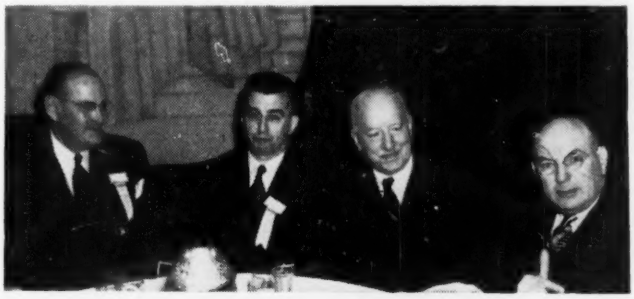
1400 ATTEND ANNUAL DINNER

By far the largest group that ever sat down for an A.S.M.E. Annual Dinner assembled in the ballroom of the Astor on Wednesday evening. James D. Cunningham, past vice-president of the Society, served as toastmaster, and seated with him at the speakers' and honors table were the guests of the Society and the recipients of honors and awards.

As soon as service of the dinner was completed, Mr. Cunningham assumed his function as toastmaster and called upon President Parker who read the list of A.S.M.E. members who, in 1942, had completed 50 years of membership in the Society. These men now join the list of "Fifty-Year Members of the A.S.M.E.," a distinction which is marked with a special medal presented by the president. The list of 1942 Fifty-Year Members follows:

TALKING IT OVER
(Left to right: J. S. Bennett, H. C. Carroll, and H. F. Lawrence.)

RAILROAD LUNCHEON
(Left to right: R. Eksergian, B. S. Cain, and R. Tom Sawyer.)



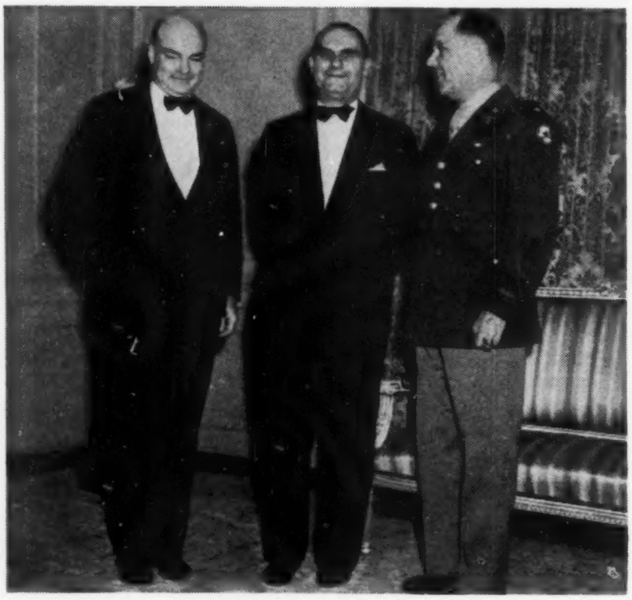
RAILROAD LUNCHEON
(Left to right: J. R. Jackson, E. L. Woodward, C. E. Smith, and A. K. Galloway.)

RAILROAD LUNCHEON
(Left to right: W. L. Woody, R. V. Wright, and Benjamin Nields.)

JUAN A. ALMIRALL
LAURENCE V. BENET
ROBERT W. BOENIG
BURTON N. BUMP
HENRY W. CARTER
WILLIAM L. DEARBORN
FREDERICK A. FLATHER
WILLIAM F. FUNK
ARTHUR G. GLASGOW
ALBERT I. JONES
CHARLES V. KERR
ALBERT KINGSBURY
S. L. G. KNOX
CHARLES LONGENECKER
A. WILBUR PARKER
FREDERICK A. PHELPS
ANDREW PINKERTON
CHARLES B. REARICK
JOHN D. RIGGS
J. G. CLIFTON SEWELL
JAMES A. SEYMOUR
HOWARD W. SMITH
WALTER D. STEELE
F. DU P. THOMSON
GEORGE G. THORP
WILLIAM W. VARNEY

Of these members Juan A. Almirall, Albert Kingsbury, A. Wilbur Parker, Howard W. Smith, and Walter D. Steele were present. At President Parker's request each of these men came forward to receive the fifty-year medal from him. Throughout the year, as occasion affords, the other members of this group will have medals presented to them personally.

President Parker then called up to receive the applause of the audience the various classes of other fifty-year, forty-five-year, forty-year, and thirty-five-year members, all of whom are now in the dues-exempt class by reason of their long period of membership. Mr. Edward Needles Trump, who joined the Society in 1880, the year of its formation, was also present, and was called upon to rise amid prolonged applause.



AT THE BANQUET ON WEDNESDAY NIGHT

(Left to right: President James W. Parker; William Loren Batt, honorary member and past-president, A.S.M.E.; Major General Levin H. Campbell, Jr., Chief of Ordnance, War Department, U. S. Army, speaker of the evening.)

MEDALS CONFERRED

During recent years the conferring of the Society's honors and awards has become an important and impressive feature of A.S.M.E. Annual Meetings. This year, five honorary memberships were conferred in addition to the customary medals and awards. The recipients of these honors were seated on the dais and were presented by Roy V. Wright, chairman of the Board of Honors and Awards. Each recipient was escorted to the microphone by one of the two marshals, D. C. Jackson and Carl L. Bausch, and was presented to the president with the reading of the citation accompanying the award. President Parker handed to each such certificates and medals as the honors provide. The recipients were as follows:

PRESENTATION OF MELCHETT MEDAL OF INSTITUTE OF FUEL, ENGLAND

(A. M. Selvey (left) presents the Melchett Medal to Arno C. Fieldner, Chief of Fuels and Explosive Service, U. S. Bureau of Mines, while President James W. Parker looks on.)

WINSTON M. DUDLEY, awarded the Junior Award for his paper, "An Analysis of Longitudinal Motions in Trains of Several Cars."

JOHN T. RETTALIATA, awarded the Pi Tau Sigma Medal for outstanding achievement in mechanical engineering.

J. KENNETH SALISBURY, awarded the Melville Medal for his paper, "The Steam-Turbine Regenerative Cycle—An Analytical Approach."

FRED H. COLVIN, awarded the Worcester Reed Warner Medal for influence toward efficiency and humanity in industry.

ERNEST O. LAWRENCE, awarded the Holley Medal for originating the cyclotron. Dr. Lawrence was unable to be present because of his war duties, but a letter from him, expressing his disappointment at not being able to receive the medal in person, and his appreciation of the honor conferred upon him, was read.

E. G. BAILEY, awarded the A.S.M.E. Medal for achievement and leadership in steam and combustion engineering.

Brief sketches of the achievements of the medalists follow:

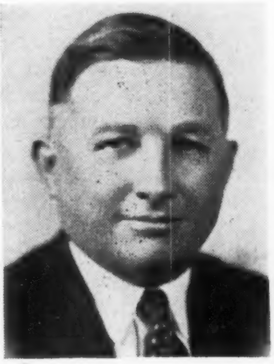
WINSTON M. DUDLEY

WINSTON M. DUDLEY, assistant professor of engineering mechanics at the Case School of Applied Science, has won the Junior Award of the A.S.M.E. for 1942 for his paper, "Analysis of Longitudinal Motions in Trains of Several Cars." Professor Dudley, who was born in Swissvale, Pa., in 1912, was graduated from the honors course in electrical engineering at Swarthmore College in 1932. During the two years following, he did graduate work in engineering mechanics at the University of Michigan, where he obtained the M.S.E. degree in 1933 and the Sc.D. in 1938. He was University Fellow in engineering mechanics there for 1933–1934. An abstract of his doctoral dissertation was published in the A.S.M.E. *Journal of Applied Mechanics*, June, 1938, under the title, "An Improved Method for Calculating Free Vibrations in Systems of Several Degrees of Freedom."

Professor Dudley began teaching at the Case School of Ap-

New Members of the 1943 A.S.M.E. Council

Vice-Presidents



J. W. ESHELMAN

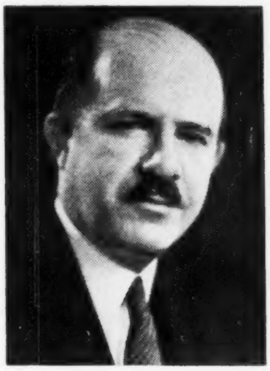
G. T. SHOEMAKER

T. E. PURCELL

W. J. WOHLENBERG

Managers

ROSCOE W. MORTON



A. R. STEVENSON, JR.

A. E. WHITE

plied Science, Cleveland, in 1934, as instructor in applied mechanics. He took his present position in 1940. He became a junior member of the A.S.M.E. in 1936 and is also a member of the S.P.E.E. and of the Sigma Xi and Sigma Tau honorary societies.

JOHN T. RETTALIATA

JOHN T. RETTALIATA has been awarded the 1942 Pi Tau Sigma Medal "for outstanding achievement in mechanical engineering." He was born in Baltimore, Md., in 1911, and studied engineering at Johns Hopkins University. After completing the undergraduate course, he returned for graduate study under Prof. A. G. Christie, receiving the degree of Doctor of Engineering in 1936.

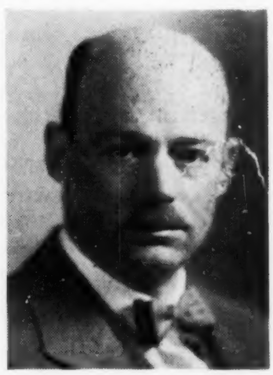
Since 1936, he has been an engineer in the turbine division of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., in charge of calculation and development. At the request of the National Academy of Sciences, he was given a leave of

Made Honorary Members of the A.S.M.E.

W. L. BATT

W. H. CARRIER

C. E. FERRIS



J. C. HUNSAKER

absence by his company during the summer of 1940 to prepare a report for the Academy on gas turbines for special applications. He has devoted his time chiefly to this type of prime mover during the past year, giving particular attention to turbines designed to operate at temperatures higher than ever used before for such equipment. In April, 1942, he was appointed a member of the N.A.C.A. Subcommittee on Supercharger Compressors of the Committee on Power Plants for Aircraft.

His paper on "The Combustion-Gas Turbine," presented at the 1940 meeting of the Oil and Gas Power Division of the A.S.M.E., won for him the 1941 Junior Award of the Society. Other papers by him include "Undercooling in Steam Nozzles," "Gas-Turbine Development," "Steam- and Gas-Turbine Design Practice," "Gas-Turbine Thermodynamic Considerations," and "Gas-Turbine Thermal Efficiency and Applications." He was co-author with J. J. Ryan of "Photoelastic Analysis of Stresses in a Steam-Turbine-Blade Root," published in the A.S.M.E. Transactions, August, 1940. He became a junior member of the A.S.M.E. in 1939.

J. Kenneth Salisbury

J. Kenneth Salisbury, recipient of the 1942 Melville Medal of the A.S.M.E., wins this award for his paper entitled "The Steam-Turbine Regenerative Cycle—An Analytical Approach." Mr. Salisbury is a design engineer in the Turbine Engineering Department of the General Electric Company at Schenectady, N. Y. He has been associated with this company since 1930. His early duties included testing steam turbines and work on the design and construction of mercury-vapor power plants. He was assigned to the turbine engineering department in 1933 and has contributed to the design of steam turbines for both central-station and marine use, and particularly to the design of naval propulsion equipment for the U. S. Navy. This work included participation in the development of high-speed, lightweight, double-reduction geared units of the type currently being used by the Navy, and the period covered the transition from the use of low pressures and temperatures to the high pressures and temperatures which are in use today.

During the past two years Mr. Salisbury has also been conducting a course in mechanical power-plant engineering at Union College under the Engineering, Science, and Management War Training Program.

Mr. Salisbury was born in 1909, in Youngstown, Ohio, and attended the Detroit Eastern High School and Wayne University prior to matriculating at the University of Michigan. He received the degree of B.S.E. in mechanical engineering in 1929 and the M.S. in that course the following year. He is a member of Sigma Xi, Phi Kappa Phi, and Iota Alpha and has been a junior member of the A.S.M.E. since 1930, holding several offices in the Schenectady Section during recent years.

FRED H. COLVIN

Fred H. Colvin, editor-emeritus of *American Machinist*, is awarded the Worcester Reed Warner Medal "for his contributions to both technical advancement and improvement in management in the metalworking industries, as influenced by more than fifty years of articles and books—particularly American Machinists' Handbook."

Mr. Colvin began writing for trade papers while still an apprentice with the Rue Manufacturing Company in Philadelphia, his first article appearing in *American Machinist* in April, 1886. In 1894, after two years with the Wheelock Engine Company, Worcester, he became the first editor of *Machinery*. Three years later he joined the staff of *Locomotive Engineering*, and in 1907 he began his long period with *American Machinist*. He retired as editor of that publication in 1940 and at present, at seventy-five years of age, is giving full time as technical consultant to the U. S. Navy, with headquarters in Washington, D. C.

Mr. Colvin joined the A.S.M.E. as a junior member in 1895, became a member in 1899, and a Fellow in 1941. Through service in this and other societies, as well as through his writings, he has accomplished much effective work. He helped to organize the first screw-thread committee of the A.S.M.E., was first chairman of its Machine Shop Practice Division, and has served on the S.A.E. Production Advisory Committee. He is also a member of The Franklin Institute.

Co-author with Frank A. Stanley of the "American Machinists' Handbook," first published in 1908; editor of the "Aircraft Handbook" (first edition in 1920); editor or author, either under his own or a pen name, of numerous books and articles on shop practice, jigs, fixtures, and gages, automobile manufacture, and plant management, Mr. Colvin has reached and helped thousands of workers in American industry.

ERNEST O. LAWRENCE

Ernest O. Lawrence, to whom the A.S.M.E. awards its Holley Medal for 1942, has also been given the Nobel Prize for physics, the Hughes Medal of the Royal Society (England), the Duddell Medal of the London Physical Society, the Elliott Cresson Medal of The Franklin Institute, the Comstock Prize of the National Academy of Sciences, and several other awards. The honorary degree of Sc.D. has been conferred upon him by eight leading universities, and he earned the degrees of A.B. from the University of South Dakota in 1922, M.A. from the University of Minnesota in 1923, and Ph.D. from Yale University in 1925. He also holds an honorary LL.D. from the University of Michigan.

The Holley Medal is given to Professor Lawrence "for originating the cyclotron, a unique invention for producing high-speed electrified particles, and for adapting it to research in physics, chemistry, medicine, and the properties of engineering materials." He is director of the Radiation Laboratory of the University of California, where he has been teaching physics since 1938. Prior to that time he was National Research Fellow at Yale, 1925–1927, and assistant professor of physics there, 1927–1928. He went to the University of California as associate professor of physics in 1928 and was advanced to full professorship two years later. He has also lectured at Cornell and Michigan summer schools, and at ten different universities under the auspices of Sigma Xi, of which he is a member, in 1937. He served as a member of the Solvay Conference in Brussels in 1933.

Professor Lawrence is a native of South Dakota, son of Carl G. Lawrence, now president-emeritus of Northern State Teacher's College, Aberdeen. He is a member of both the National and American Academy of Sciences, the American Academy of Arts and Sciences, the A.A.A.S., the American Physical Society, and the American Philosophical Society.

E. G. BAILEY

E. G. Bailey receives the highest award of the A.S.M.E., "for achievement and leadership in steam and combustion engineering." During the past thirty years, he has been granted nearly one hundred patents, involving improvements in efficiency and operation in fuel burning and steam generation. As vice-president of the Babcock & Wilcox Co. and president of the Bailey Meter Company, he has made successful applications of his inventions, benefiting the public through making possible lower costs for power production. His achievements have brought him the Longstreth Medal of The Franklin Institute in 1930, the Lamme Medal of The Ohio State University in 1936, and the Percy Nicholls Award, 1942; the honorary degree of Doctor of Engineering from Lehigh University in 1937

Recipients of Medals and Awards

F. H. COLVIN
(*Worcester Reed Warner Medal.*)

E. G. BAILEY
(*A.S.M.E. Medal.*)

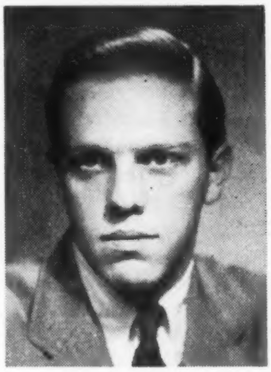
E. O. LAWRENCE
(*Holley Medal.*)

J. K. SALISBURY
(*Melville Medal.*)

J. T. RETTALIATA
(*Pi Tau Sigma Medal.*)

A. C. FIELDNER
(*Melchett Medal, England.*)

W. M. DUDLEY
(*Junior Award.*)



J. P. LAIRD
(*Undergradute Student Award.*)

A. W. MCCLURE
(*Postgraduate Student Award.*)

B. J. ISABELLA
(*Charles T. Main Award.*)

and from The Ohio State University in 1941; and that of Doctor of Science from Lafayette College in 1942.

Mr. Bailey, a member of the A.S.M.E. since his graduation from Ohio State with an M.E. degree in 1903, was born in Ohio in 1880. His early experience included four years in the Testing Department of the Consolidation Coal Company, Fairmont, W. Va., two years in charge of the Coal Department of Arthur D. Little, Boston, Mass., and six years as a partner in the Fuel Testing Company, Boston. He became founder and president of the Bailey Meter Company, Cleveland, Ohio, in 1915, was president of the Fuller Lehigh Company from 1926 to 1935, and has been vice-president of B. & W. since 1930.

Mr. Bailey's many contributions to the technical press, making public the results of his studies and practical research, have been of invaluable benefit to modern civilization. He has rendered important service through committee work in the A.S.M.E., particularly as a member of the Society's Standing Committee on Research.

Other societies of which Mr. Bailey is a member include the A.I.M.E., Society of Naval Architects and Marine Engi-

neers, Newcomen Society, and the Sigma Xi and Tau Beta Pi honorary societies.

FIVE HONORARY MEMBERSHIPS CONFERRED

Honorary memberships were conferred on the following:

WILLIAM L. BATT, vice-chairman, War Production Board, and president, SKF Industries, Inc., Philadelphia, Pa.

WILLIS H. CARRIER, chairman of the board, Carrier Corporation, Syracuse, N. Y.

CHARLES E. FERRIS, dean-emeritus, College of Engineering, University of Tennessee, Knoxville, Tenn.

JEROME C. HUNSAKER, chairman, National Advisory Committee for Aeronautics, Washington, D. C.

HARRY R. RICARDO, technical director, Ricardo and Company, Ltd., Sussex, England. Mr. Ricardo was not present, but arrangements are being made to present his certificate of honorary membership to a representative of the British Government, probably at a function to be held in Washington, D. C., in the near future.

As this is the first announcement of the elections of these honorary members it is appropriate to include here brief sketches of the achievements of the engineers thus honored.

WILLIAM L. BATT

WILLIAM L. BATT, whose capacity for leadership has put him in many responsible posts and brought him wide recognition, is now serving the nation as vice-chairman of the War Production Board. For nearly three years he has been active in government work, first as chairman of the Business Advisory Council of the Department of Commerce, and then successively as deputy commissioner, Industrial Materials Division, Advisory Commission to the Council on National Defense; deputy director, Production Division, O.P.M.; member of the Harriman Mission to Moscow in 1941, with the temporary rank of Minister Plenipotentiary and Extraordinary; and director of materials, O.P.M. He was appointed to this present office in July, 1942.

The SKF Industries, Inc., of Philadelphia, Pa., represents his administrative ability in private industry. Not long after his graduation in mechanical engineering from Purdue University in 1907, he became associated with the Hess-Bright Manufacturing Company, manufacturers of antifriction bearings, which in 1917 was consolidated with others to form the present organization, with Mr. Batt as vice-president. He has been its president since 1922, and is a director of several other companies.

Mr. Batt has contributed much to the philosophy and statesmanship of management, in recognition of which he was given the Gantt Medal for 1940. He has served as vice-president of the Board of Directors of the Swedish Chamber of Commerce in the U. S. A., and for his interest and activity in promoting commercial relations with Sweden received the decorations of the Order of Vasa and Royal Order of the North Star from King Gustav V. Purdue University conferred the degree of Doctor of Engineering upon him in 1933.

A member of the A.S.M.E. since 1911, Mr. Batt has given generously of his time to its work as a member of a number of its committees and in the offices of manager, vice-president, and president (1936). He became a Fellow of the Society in 1938. He is also a member of the S.A.E., Newcomen Society, and Tau Beta Pi. His technical papers and addresses before these and other organizations reflect his clear insight into the problems of his profession and his country.

WILLIS H. CARRIER

WILLIS H. CARRIER, in being given honorary membership in the A.S.M.E., to which he has belonged since 1905, is honored by this Society a second time, the A.S.M.E. Medal having been presented to him in 1934. He has also received the John Scott, F. Paul Anderson, and Frank P. Brown medals for his achievements in heating and ventilating, refrigeration, and air conditioning, and has been named a "Modern Pioneer of Industry" by the National Association of Manufacturers.

Born at Angola, N. Y., in 1876, he taught school for a time before entering Cornell University, where he secured his M.E. degree in 1901. Upon graduation he was employed as a research engineer with the Buffalo Forge Company, of which he became chief engineer in 1906. During this association he contributed notably to the design of the conoidal fan and centrifugal water pumps, established a rational accurate method of estimating heating capacities and requirements on the British thermal unit basis, and formulated and tabulated the capacities of heating surfaces in relation to air velocities. His paper on "Rational Psychrometric Formulae," presented at the A.S.M.E. Annual Meeting in 1911, laid the foundation for much of the exact knowledge now available in the science of air conditioning.

In 1915, with J. Irvine Lyle and others, he founded the Carrier Engineering Corporation, Newark, N. J. By 1937 this organization had five factories, at different points, devoted to the construction of air-conditioning systems of various types for many purposes. These factories were brought together in one large plant of the Carrier Corporation at Syracuse, N. Y., in 1937. Mr. Carrier is chairman of the board of the corporation.

Mr. Carrier's other inventions include dew-point control, the differential hygrostat, and the centrifugal refrigeration machine. He has made many contributions to engineering literature in his field, is president of the American Society of Heating and Ventilating Engineers and past-president of the American Society of Refrigerating Engineers, and has rendered valuable service through engineering commissions and committees for many years. He holds the honorary degree of D.Sc. from Alfred University and that of Doctor of Engineering from Lehigh University. He is a fellow of the American Society for the Advancement of Science and of the Royal Society of Arts.

CHARLES E. FERRIS

CHARLES E. FERRIS, dean-emeritus of engineering at the University of Tennessee, completed fifty years of service there and was retired in June, 1942. He was born in Ohio in 1864, secured a B.S. degree from Michigan State College in 1890, and spent two years in civil-engineering work in Michigan and Kentucky. He joined the faculty at the University of Tennessee as instructor in mechanical drawing and became professor of mechanical engineering in 1900. Ten years later he was appointed the first dean of engineering. To his guidance, thoughtful planning, and untiring energy the growth and success of the College of Engineering may be largely attributed.

Both his students and those associated with him as teachers testify to the fulfillment of his ambition to become a "great teacher." His personality, embodying modesty and unselfishness, coupled with his ability to impart knowledge to others, have molded both the character and professional attainments of many engineering students, and he has exercised outstanding leadership in the development of the younger men of his staff.

The University of Tennessee has recognized the services of Dean Ferris by naming the latest College of Engineering building "Ferris Hall."

Among the writings of Dean Ferris are a textbook on "Elements of Descriptive Geometry," and a "Manual for Engineers." A text on "Thermodynamics" is in manuscript form.

Dean Ferris was active in the founding of the Technical Society of Knoxville, and since becoming a member of the A.S.M.E. in 1904, has contributed much to its upbuilding and work in the South.

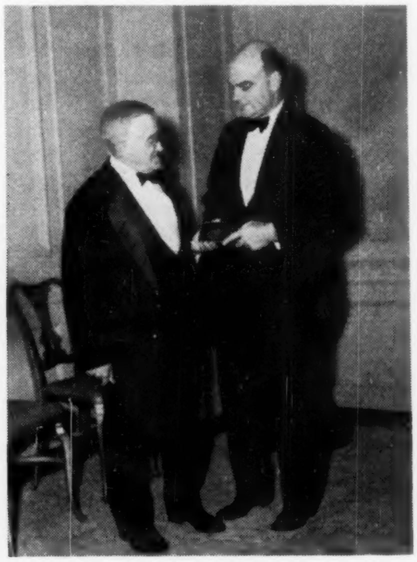
GEORGE J. NICASTRO, ALEX D. BAILEY, AND CHARLES HESCHELES

PRESIDENT-ELECT COES, SECRETARY DAVIES, AND PRESIDENT PARKER

A. R. STEVENSON, JR., PRESIDENT PARKER, AND IGOR I. SIKORSKY

RUPEN EKSERGIAN AND A. I. LIPETZ ATTEND RAILROAD SESSION

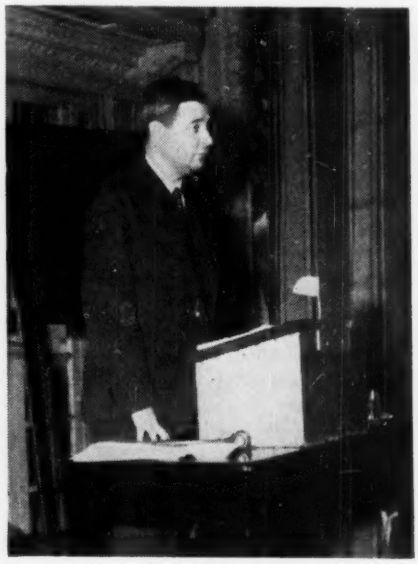
PRESIDENT PARKER CONGRATULATES PRESIDENT-ELECT COES



PRESIDENT PARKER PRESENTS WORCESTER REED WARNER MEDAL TO FRED H. COLVIN

ALONZO D. GRACE AT MEETING ON EDUCATION AND TRAINING

PAUL B. EATON AT MEETING ON EDUCATION AND TRAINING



JAMES N. LANDIS AT MEETING ON EDUCATION AND TRAINING

Honorary membership in the Society is conferred upon Dean Ferris for his contributions to college administration, his stature as a builder of men, his service to state and nation, and further, as a tribute to his personal grace and charm, learned attainments, becoming modesty, and simplicity of character—the true attributes of a great teacher and citizen of the nation.

JEROME C. HUNSAKER

JEROME C. HUNSAKER, Commander, U.S.N., chairman, National Advisory Committee for Aeronautics, Washington, D. C., has made many contributions to the science of aerodynamics, to the science and art of aircraft design, and to the practical construction and commercial utilization of rigid airships. For these achievements, which have already won him the Daniel Guggenheim Medal and the U. S. Navy Cross, he is now given honorary membership in the A.S.M.E. He has been a member of this Society since 1933 and has served as a vice-president of it (1939–1941). He was for five years a member of the Executive Committee of the Applied Mechanics Division and subsequently has been an associate of the committee.

A native of Iowa, Commander Hunsaker was graduated from the U. S. Naval Academy at the age of twenty two, and commissioned an officer in the Construction Corps of the Navy. He was permitted to take graduate studies at M.I.T., where he received the degrees of M.S. in 1912 and D.Sc. in 1916. During the next four years he was assigned to the M.I.T. faculty as an instructor in aeronautical engineering. Then, from 1916 to 1923, in which period he was advanced to the grade of commander, he was in charge of aircraft design in the Navy Department in Washington. Here he designed the U. S. S. *Shenandoah* and the flying boat *NC4*. From 1923 to 1926 he was assistant naval attaché to the American embassies in London, Paris, Berlin, and Rome.

After retiring from the Navy in 1926, he became assistant vice-president of the Bell Telephone Laboratories, where he developed wire and radio services for the airways of America. As vice-president of the Goodyear-Zeppelin Corporation, 1928–1933, he helped design and build the U. S. S. *Akron*. Since 1933 he has been head of the department of mechanical engineering at M.I.T. and also in charge of the Guggenheim Aeronautical Laboratory there.

Commander Hunsaker is a fellow of the American Physical Society and of the American Academy of Arts and Sciences; an honorary fellow of both the Institute of Aeronautical Sciences and the Royal Aeronautical Society of Great Britain; and a member of the National Academy of Sciences, American Society of Naval Architects, Society of Automotive Engineers, and Sigma Xi.

HARRY R. RICARDO

HARRY R. RICARDO, of Sussex, England, technical director of Ricardo and Company, Ltd., consulting engineers, since 1919, holds first place in internal-combustion-engine research in the world today. Educated at Rugby School and at Trinity College, Cambridge, he joined the staff of Rendel, Palmer, and Tritton, consulting engineers, in 1906, and for nearly ten years was mechanical engineer for that organization, dealing with locomotives, steam plants, and Diesel engines. During World War I he designed engines for tanks and acted as consulting engineer to the Mechanical Warfare Department and to the Air Ministry. He has subsequently held many responsible appointments in the Air Ministry.

Mr. Ricardo has set forth some of the results of his research in volumes on "The Internal Combustion Engine" and "Engines of High Output," and in a number of technical papers. He is vice-president of The Institution of Mechanical Engineers.

Owing to war conditions, the presentation of the Melchett Medal, of The Institute of Fuel (Great Britain), to Arno C. Fieldner, chief of the Fuels and Explosives Service, Bureau of Mines, Washington, D. C., could not be made in person. Hence A. M. Selvey, member A.S.M.E., and son of Wm. M. Selvey, member A.S.M.E., and president, The Institute of Fuel, made the presentation at the A.S.M.E. Annual Dinner.

TWO PRESIDENTS ADDRESS SOCIETY

With the conferring of the honors and awards, James D. Cunningham took over once more his task of toastmaster and introduced James W. Parker, president of the Society, who delivered the 1942 Presidential Address, "The Spirit of a People," which is published in this issue.

Mr. Parker was followed by Harold V. Coes, president-elect of the A.S.M.E., who spoke briefly in appreciation of the honor done him by his election to office. The trust and confidence thus placed in him, he said, would afford him an opportunity to discharge his personal obligations to the Society, for no group had exercised more influence on his life and thinking than had The American Society of Mechanical Engineers. He pledged himself to forward the ideals, aims, and objectives of the Society and its contribution to the war effort. He was sure, he said, that the Society would respond to the challenge of the times as it had always done.

Following Mr. Coes' brief address, Mr. Cunningham introduced the other members of the Council elected in 1942 to serve with Mr. Coes:

Vice-Presidents: J. W. Eshelman, G. T. Shoemaker, T. E. Purcell, and W. J. Wolhenberg.

Managers: Roscoe W. Morton, A. R. Stevenson, Jr., and A. E. White.

GENERAL CAMPBELL SPEAKS ON ORDNANCE DEPARTMENT

The principal address of the 1942 A.S.M.E. Annual Dinner was delivered by Major General Levin H. Campbell, Jr., chief of Ordnance, War Department, U. S. Army, Washington, D. C. General Campbell spoke without reference to his prepared address, which appears elsewhere in this issue, although he followed it closely in substance if not in wording. His animated manner and vigorous picturesque method of speech captured the immediate and continued interest of his listeners. Many phrases, characteristic of him, will be long remembered, even though they are not to be found in the printed record.

General Campbell's address was concerned largely with the organization of the Ordnance Department. Fortunately, many of his staff were present at the dinner, including Col. C. E. Davies, secretary A.S.M.E., and to these men the General paid affectionate tribute, while insisting that they stand to receive the applause of the audience.

Following General Campbell's address, the ballroom was cleared for dancing and a reception of the presidents and their wives and other honored guests was held in the Rose Room. Dancing followed until 2 o'clock.

TECHNICAL SESSIONS

It is the aim of the divisions and committees responsible for the technical programs of A.S.M.E. Annual Meetings to secure copies of papers to be presented far enough in advance so that the Committee on Publications may put them in preprint form for the use of discussers and members of the Society. Owing to the heavy demands of war work on a majority of authors, very few manuscripts were received by the date set and hence the number of preprints available at the sessions was not as large a proportion of the papers actually presented as is usually the case. In fact, however, the number of preprints actually on hand for distribution, 51, was as great as ever, and to this must be added preprints supplied by the authors themselves.

Because of space limitations, the availability in preprint form of a considerable proportion of the papers presented, and the fact that the publications of the Society, MECHANICAL ENGINEERING, the Transactions, and the *Journal of Applied Mechanics*, have already or will, within a year, contain the papers and discussions, no attempt will be made here to do more than summarize what the program contained.

In the first place it may be stated that the 1942 program contained more papers than ever before were presented at an Annual Meeting. Moreover, the diversity of subject matter was unusually broad. Comments on the quality of the papers and their value indicated that the agencies responsible for the program succeeded in arousing the interest of a majority of the engineers in attendance. Throughout the program subject matter which fitted into the nation's immediate interest with the war effort was featured. War production and war manpower were treated in several sessions from many points of view. The programs of the Management, Production Engineering, Aviation, Power, Applied Mechanics, Heat Transfer, Process Industries, Oil and Gas Power, and Railroad Divisions were particularly strong and popular. In addition to these, the programs of other divisions and of seven Society committees drew gratifying numbers of engineers, despite the fact that in almost every case each session was competing against four others, to say nothing of numerous committee meetings and other activities.

In connection with a paper presented by Thornton Lewis, deputy chief, Production Service Branch, Ordnance Department, U. S. Army, entitled "Tremendous Trifles of the Army Ordnance Department," there was a display of some of the results of the efforts of the Ordnance Department in its campaign to conserve critical materials and machinery.

COLLEGE REUNIONS

A traditional feature of the A.S.M.E. Annual Meeting program is the College Reunion Night, which customarily falls on Thursday. Increase in number of sessions has made it necessary, in recent years, to schedule technical papers for Thursday evening. However, the college reunions persist.

This year the following reunions were held: Clarkson College, a dinner on Friday evening; Columbia University, a luncheon on Thursday noon; Cornell University, a buffet dinner on Thursday evening; Harvard Engineering Society, a regular meeting on Thursday evening; University of Kentucky, a luncheon on Thursday noon; Massachusetts Institute of Technology, a smoker on Thursday evening; Pratt Institute, a dinner on Thursday evening; Purdue University, a dinner on Thursday evening; Yale Engineering Association, a smoker on Thursday evening.

COMMITTEES

Annual Meetings of The American Society of Mechanical Engineers are conducted by the Committee on Meetings and Program, which, in 1942, consisted of A. L. Kimball, chairman, N. E. Funk, L. K. Sillcox, F. G. Switzer, R. A. North, and E. J. Nobles, junior advisor. The technical program is arranged, in co-operation with the Committee on Meetings and Program, by the professional divisions and technical committees of the Society.

Special committees appointed to carry on certain features of the meeting assist in its planning and operation. The 1942 Committees consisted of the following:

Reception: Frank C. Carvin, chairman; R. L. Anthony, C. W. Burgess, F. J. Burns, H. S. Cameron, J. B. Cejka, A. H. Church, A. C. Coonradt, A. E. Doll, F. S. Egilsurd, W. R. Grosser, G. A. Guerdan, C. E. Gus, U. C. Holland, A. T. Kniffen, J. M. Lamberton, J. A. Lambertine, K. E. Lofgren, C. W. Lytle, E. L. Midgette, H. F. Mullikin, G. J. Nicastro, D. B. Porter, K. E. Quier, L. F. Rahm, H. F. Ritterbusch, E. A. Salma, J. S. Setchell, C. C. Tyrell, and H. E. Walter.

Dinner and Honors Night: J. F. Daggett, chairman; H. G. Ebdon, vice-chairman; C. A. Heschleles, seating; W. H. Larkin, music and dancing; E. W. Legier, ushers; Mrs. E. C. M. Stahl, "asKme."

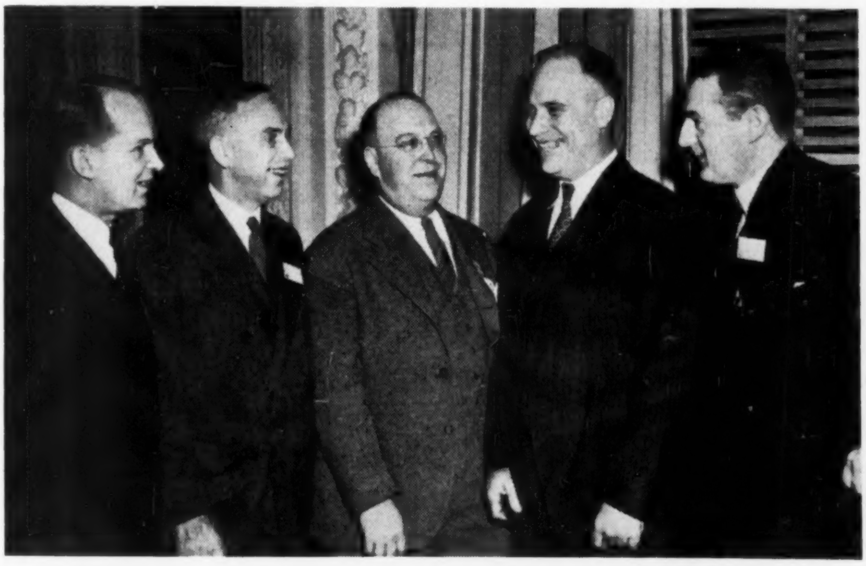
Entertainment: T. B. Allardice, chairman.

Plant Trips: F. P. Fairchild, chairman.

Photographic Group: F. P. McCormack, chairman; W. L. Betts, J. F. Guinan, C. G. Humphreys, G. C. Hyde, and F. C. Petura.

Student Aides: E. E. Jackson, chairman; A. H. Church, Howard Judson, C. F. Kayan, K. E. Quier, W. A. Vopat.

Women's Events: Mrs. J. N. Landis, general chairman; Mrs. G. E. Hagemann, vice-chairman; Mrs. F. M. Gibson, registration; Mrs. E. B. Smith, program and tickets; Mrs. R. M. Gates, decorations; Mrs. R. B. Purdy, annual luncheon; Mrs. Crosby Field, excursions; and Mrs. C. H. Young, Monday tea.



WELL-KNOWN PERSONALITIES AT 1942 ANNUAL MEETING
(T. Fort, P. W. Thompson, N. E. Funk, C. M. Laffoon, and W. V. Drake.)

COMMENTS ON PAPERS

Including Letters From Readers on Miscellaneous Subjects

Patent Legislation

To the Editor:

Why should a busy engineer devote time to legislation concerning patents? My answer is that if he does not, the patent system, largely responsible for American industrial advancement, will be injured or destroyed. Two bills are pending in Congress which tend to make patents mere revokable franchises. Patents are now vested property rights, given in return for value received

The purpose of the two bills, both with the same sponsors, seems to be to discourage patenting and this, beyond any question, is to impair seriously the progress of the arts and sciences which the Constitution sought to advance.

The first of these bills, S. 2303, throws open to general license any patent covering anything that the President finds need for in the interest of national defense. The United States assumes no obligation and leaves the patent owner to bring suit after the duration of the war for what will be limited to "fair" compensation. The President may grant licenses at a royalty to be fixed by him, or he may declare that expansion of facilities for the making of some article is in interest of national defense. In the latter case, no license is given anyone, but the patent owner is barred from injunctive relief for the duration and is limited to a royalty not to exceed that which the President sets.

The second bill is S. 2491, called the "Patent Act of 1942," and is permanent legislation. In addition to providing compulsory licensing for patents yet to be granted, it seriously restricts the right to grant licenses under existing patents and requires much paper work. It calls for filing a copy of every sale, assignment, or other conveyance of any part or all of the rights under a patent with the Federal Trade Commission which will maintain a public register of these documents. Failure to file within thirty days may cost \$1000 plus \$10 for each day over the thirty allowed. The patent owner is forbidden to sue a seller of the infringing article unless he first finds the actual maker and obtains a decree against the latter.

Just one example will show how fallacious is the oft-repeated argument that patents have caused bottlenecks in the war effort. Thurmond Arnold cited the Dzuz fastener case as "having sensational aspects." Actually, the inventor has granted three licenses, free from royalty, to Fisher Body, North American, and the Bell Airplane. There are many other screws of this kind, even granting that this may be the best. But, fundamentally, how could this patent, or any other patent, hold up production after Pearl Harbor when the law for years has provided that in wartime all government contractors are absolutely immune from patent interference, the sole remedy of the patent owner being by a suit against the Government through its Court of Claims? The only answer is that the executive branch of the Government, by drawing contracts shifting the responsibility to the contractor, has negatived the carefully planned work of the legislative branch. The present law speeds the war effort by making the Government responsible for patent infringement in its behalf; the practice of deducting the cost of litigation from the contractor's bill retards the war effort and encourages the use of poorer methods and materials which are free of patents. Under these new bills, the patent owner sues the contractor and is limited in his recovery while the Government is immune.

No one suggests for a moment that the patent laws are perfect. Their shortcomings have been well advertised. This writer vigorously asserts that patent practice is no more in need of drastic revision than is medical, legal, or other professional practice. He suggests that the proper manner by which the patent laws and practices may be improved is by complete periodic revision by a body of highest integrity, entirely free from political motives and personal interest. That the patent system has been responsible largely for the advance of American industry cannot be challenged. To destroy it at the demand of public clamor, instigated by those who distort facts to suit their own objectives, would be to lessen the horizon of all engineers.

Henry H. Snelling.[1]

[1] Patent Lawyer, Washington, D. C., Past Vice-President, A.S.M.E.

A.S.M.E. BOILER CODE

Interpretations

The Boiler Code Committee meets monthly for the purpose of considering communications relative to the Boiler Code. Anyone desiring information on the application of the Code is requested to communicate with the Committee Secretary, 29 West 39th St., New York, N.Y.

The procedure of the Committee in handling the cases is as follows: All inquiries must be in written form before they are accepted for consideration. Copies are then sent by the Secretary of the Committee to all of the members of the Committee. The interpretation, in the form of a reply, is then prepared by the Committee and is passed upon at a regular meeting.

This interpretation is later submitted to the Council of The American Society of Mechanical Engineers for approval after which it is issued to the inquirer and also published in Mechanical Engineering.

Following is a record of the interpretations of this Committee formulated at the meeting of October 23, 1942, subsequently approved by the Council of The American Society of Mechanical Engineers.

Case No. 850

(Annulled)

Case No. 917

(Annulled)

Case No. 944 (Reopened)

Revised item (5)

(5) The assembler's stamp, together with the name of the assembler or acceptable abbreviation, shall be applied in the field on the boiler near the stamping

called for by Par. P-332*e*, when authorized by the field inspector, after the hydrostatic test. This stamping shall also be reproduced on a name plate as provided for in Par. P-332*e* (See Case No. 964).

CASE No. 971 (Reopened)

(*Interpretation of Pars. P-105(c) and U-74*)

Inquiry: On the basis of test data submitted, will it be permissible to depart from the requirements of Pars. P-105(*c*) and U-74 and drill tube holes through welded seams which have been radiographed and stress-relieved?

Reply: Based on the evidence acquired from extensive experimental test programs, it is the opinion of the Boiler Code Committee that it will be permissible to suspend the restrictions of Pars. P-105(*c*) and U-74 and to allow unreinforced holes to be machine-cut through welded seams that have been stress-relieved and radiographed. The joint efficiency as well as the ligament efficiency shall be considered in calculating the thickness.

Tubes may be rolled and expanded in such unreinforced holes, or such holes may be threaded, provided that in the portion of the welded joint in which the holes are cut the following additional requirements are met:

(1) The welds have been examined by the magnetic powder method on both sides and found to be satisfactory;

(2) The weld shall contain no slag inclusion or defect longer than $0.15t$ (where t is the thickness of the weld), but in no case greater than $^3/_8$ in.

If either or both items (*1*) and (*2*) are not complied with, the unreinforced holes for threaded connections or for rolled or expanded tubes may not be placed closer than $^1/_4$ in. to the edge of the fused metal, and no deduction need be made in the maximum allowable working pressure computed for the same tube layout without a circumferential weld.

Revisions and Addenda to Boiler Construction Code

IT IS the policy of the Boiler Code Committee to receive and consider as promptly as possible any desired revision of the rules and its codes. Any suggestions for revisions or modifications that are approved by the Committee will be recommended for addenda to the code, to be included later in the proper place.

The following proposed revisions have been approved for publication as proposed addenda to the code. They are published below with the corresponding paragraph numbers to identify their locations in the various sections of the code and are submitted for criticism and approval from anyone interested therein. It is to be noted that a proposed revision of the code should not be considered final until formally adopted by the Council of the Society and issued as pink-colored addenda sheets. Added words are printed in SMALL CAPITALS; words to be deleted are enclosed in brackets [ ]. Communications should be addressed to the Secretary of the Boiler Code Committee, 29 West 39th St., New York, N. Y., in order that they may be presented to the Committee for consideration.

REVISIONS

Preamble to Code for Unfired Pressure Vessels. Add the following:

These rules are intended to apply to vessels for pressures not exceeding a range of 2500 to 3000 lb per sq in. It is recognized that for higher pressures certain deviations or additional requirements may be necessary in view of the greater thicknesses and fabrication limits involved.

PAR. U-72(*f*). Revise to read:

(*f*) The design of welded vessels shall be such, that IF bending stresses are brought directly upon a welded joint, THE DESIGN SHALL BE ANALYZED TO KEEP THE MAXIMUM STRESS WITHIN THE ALLOWABLE LIMITS, AND COMPLETE WELD PENETRATION THROUGH THE THICKNESS OF THE JOINED PLATES SHALL BE OBTAINED, WITH ADDED FILLET WELDS WHERE NECESSARY TO REDUCE STRESS CONCENTRATION. Corner joints with fillet welds only shall not be used unless the plates forming the corner are properly supported independently of such holes.

BOOKS RECEIVED IN LIBRARY

THEORETICAL NAVAL ARCHITECTURE. By E. L. Attwood, revised by H. S. Pengelly. Longmans, Green & Co., Inc., New York, N. Y., London, England; Toronto, Canada; 1942. Cloth, 5 × 8 in., 526 pp., diagrams, charts, tables, $5. The purpose of this well-known textbook is to provide students and draftsmen with an explanation of the calculations that continually have to be performed, and of the principles underlying them. Copious examples illustrate the rules. This issue of the book is the nineteenth printing, apparently of the revised 1931 edition.

THIS FASCINATING RAILROAD BUSINESS. By R. S. Henry. Bobbs-Merrill Co., Inc., New York, N. Y., and Indianapolis, Ind., 1942. Cloth, 6 × 9 in., 520 pp., illus., diagrams, charts, $3.50. A very readable, yet unusually detailed and comprehensive account of American railroading is provided in this volume, which should be of interest both to laymen and to railroad men. Every aspect of railroading as a business is covered, and while the subject is primarily the railroad companies of today, much historical information is included. The author is an experienced railroad man.

WATER HANDBOOK, Chemical Analyses and Interpretations. Published by W. H. and L. D. Betz, Frankford, Phila., Pa., 1942. Paper, spiral binding, $8^1/_2$ × 11 in., 64 pp., illus., diagrams, charts, tables, $0.50. This handbook is in two parts. Part one gives clear, definite directions for water analysis, covering all the tests commonly used in industrial plant control and presenting simple methods which do not require previous chemical experience. Part two discusses the interpretation of the tests and their application.

WHAT THE CITIZEN SHOULD KNOW ABOUT CIVILIAN DEFENSE. By W. D. Binger and H. H. Railey. W. W. Norton & Co., New York, N. Y., 1942. Cloth, $5^1/_2$ × $8^1/_2$ in., 183 pp., diagrams, $2.50. This book presents the advice of an experienced civil engineer and a writer upon military affairs as to proper methods of dealing with the civil problems arising out of enemy air action. The various types of bombs are described, and instructions as to protection against the mgiven. Construction of shelters, preparation of black-outs, fire control, and gas are dealt with.

WELDING HANDBOOK. American Welding Society, New York, N. Y., 1942 edition. Cloth, 6 × 9 in., 1593 pp., illus., diagrams, charts, tables, $6 in U. S. A.; $6.50 in foreign countries; $5 to members of American Welding Society. The aim in preparing this work has been to give engineers an authoritative, up-to-date reference book on the technical phase of welding. The physics and metallurgy of welding, the weldability of steels, welding processes, brazing, soldering, facing, metal spraying, metal cutting, metals used, training, inspection, safety, design and testing of welds, and applications are discussed.

X-RAY CRYSTALLOGRAPHY. By M. J. Buerger. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, London, England, 1942. Cloth, 6 × $9^1/_2$ in., 531 pp., illus., diagrams, charts, tables, $6.50. The text is intended to fill a lack in the equipment of the crystallographer by providing a connected account of the theory and practice of structural investigations by means of the X ray. It is restricted to methods that utilize a single crystal and monochromatic X rays and to the theory necessary for the intelligent use.

Library Services

ENGINEERING Societies Library books may be borrowed by mail by A.S.M.E. members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Harrison W. Craver, Director, Engineering Societies Library, 29 West 39th St., New York, N. Y.

A.S.M.E. NEWS

And Notes on Other Engineering Activities

A.S.M.E. Executive Committee and Council Discuss Society Affairs During 1942 Annual Meeting

BEGINNING on Sunday morning, November 29, and running through Monday morning, the Executive Committee and the Council of The American Society of Mechanical Engineers met at the Hotel Astor to conduct Society business and discuss its affairs. On Monday afternoon members of the Council attended the Annual Business Meeting of the Society, and on Monday evening they met with members of special and standing committees for a series of informal discussions.

Resuming its deliberations on Friday morning, this time at the Society headquarters, the 1942 Council, with James W. Parker as its president, adjourned, and the 1943 Council, with Harold V. Coes as its president, convened for its first session. Actions of general interest taken at these sessions are reported in what follows.

Actions of Executive Committee

At the meeting of the Executive Committee, James W. Parker, president of the Society, presiding, there were present: Clarke Freeman, vice-chairman; George E. Hulse, Thomas S. McEwan, Clair B. Peck, of the committee; Joseph L. Kopf (Finance); C. E. Davies, secretary, and Ernest Hartford, executive assistant secretary; Samuel B. Earle, Paul B. Eaton, Joseph W. Eshelman, Linn Helander, Warren H. McBryde, Edwin B. Ricketts, Guy T. Shoemaker, and Willis R. Woolrich, members of the Council; and Roscoe W. Morton and Albert E. White, Council Members-elect.

Honorary Members

Clair B. Peck and Edwin B. Ricketts, tellers appointed to canvass the ballots on honorary membership reported the election to honorary membership of William L. Batt, Willis H. Carrier, Jerome C. Hunsaker, Charles E. Ferris, and Harry R. Ricardo.

Dropping Delinquent Members

Extension to March 1 was voted of the time in which payment of dues in arrears may be made before members will be dropped for nonpayment.

Engineering Societies Personnel Service

It was reported that there is approximately $60,000 in the treasury of the Engineering Societies Employment Service and its branch offices, in view of which the matter of continuing financial support to the Service was referred to the Finance Committee.

Meetings of the Society

Resolutions of thanks adopted at the Fall Meeting of the Society, Rochester, N. Y., Oct. 12–14, 1942, were approved. The Committee also approved June 14–16 as the dates of the 1943 Semi-Annual Meeting, to be held at Los Angeles, Calif.

Resolution on Selective Service

A resolution, presented by the Committee on Professional Divisions, urging that "the president of A.S.M.E. meet with the presidents of other engineering Societies with a view to making a strong representation to the President of the United States that the present policy of selective service be implemented in order to define a national policy assuring a continuous supply of engineers and scientists to the American people," was referred to R. E. Doherty, chairman of the Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission.

[The Consultative Committee of which Dr. Doherty is chairman met in New York on December 8 and made recommendations to Dr. Elliott, chairman of the Professional and Technical Division of the War Manpower Commission, that are reported elsewhere in this issue.—EDITOR.]

Chas. T. Main Award

Confirmation was voted of letter-ballot approval of the recommendation of the Board of Honors and Awards to confer the Chas. T. Main award for 1942 on Bernard J. Isabella.

E.C.P.D. Unionism Committee

The president was authorized to select the A.S.M.E. representative to serve on a Committee on Unionism proposed by the Engineers' Council for Professional Development.

C. B. LePage to Serve in Washington

Approval was voted to assign to duty, in Washington in the Simplification Branch of the War Production Board, the services of C. B. LePage, assistant secretary of the Society, for three days a week over a three-month period.

1942 Council Meeting

With President James W. Parker presiding, the Council of the A.S.M.E. met at the Hotel Astor on Sunday afternoon and reconvened on Monday morning. At one time or another during these sessions there were present: A. G. Christie, H. N. Davis, W. A. Hanley, and W. H. McBryde, past-presidents; S. B. Earle, Clarke Freeman, K. M. Irwin, C. B. Peck, F. H. Prouty, and E. B. Ricketts, vice-presidents; W. G. Christy, H. O. Croft, P. B. Eaton, J. W. Eshelman, Linn Helander, G. E. Hulse, T. S. McEwan, and G. T. Shoemaker, managers; C. E. Davies, secretary; H. V. Coes, W. J. Wohlenberg, R. W. Morton, A. E. White, and T. E. Purcell, Council Members-elect; S. R. Beitler (Constitution and By-Laws), J. L. Kopf (Finance), John Blizard (Library), J. N. Landis (Local Sections), C. J. Freund (Economic Status of the Engineer), and E. S. Dennison (Oil and Gas Power Division); H. T. Avery, B. G. Elliott, and A. M. Selvey (Local Section Delegates); F. H. Fowler, Jr., F. M. Gibson, Jr., E. J. Nobles, and P. B. Petty (junior observers); Paul Wright, A. D. Bailey, K. H. Condit, and H. H. Snelling (guests); Ernest Hartford, executive assistant secretary; R. L. Sackett, assistant to secretary, and George A. Stetson, editor.

Honorary Members

Confirmation was voted of election by letter ballot as honorary members of the Society of the following: William L. Batt, Willis H. Carrier, Charles E. Ferris, Jerome C. Hunsaker, and Harry R. Ricardo.

Committee Reports

The annual reports of the Council, standing and special committees, and representatives on joint activities were adopted.

[The report of the Council is published in this issue. Copies of the other reports referred to were distributed at the Annual Business meeting and may be had by applying to the Secretary.—EDITOR.]

A.S.M.E. Calendar
of Coming Meetings

April 26–28, 1943
Spring Meeting
Davenport, Iowa

June 14–16, 1943
Semi-Annual Meeting
Los Angeles, Calif.

(For coming meetings of other organizations see page 30 of the advertising section of this issue)

The President's Letter

To A.S.M.E. Members:

The possibility of transportation difficulties and my personal obligation in the war effort may reduce the number of visits I can make to the local sections and student branches. I am therefore planning to discuss Society problems from time to time in this space in MECHANICAL ENGINEERING. I will welcome your suggestions of matters which should be given attention.

During my term, I propose to give aid to the staff and to the administrative problems of the Society which under the emergency are frequently critical.

The immediate business of the Society is the war. As an organization it is helping and is planning more help. Your views as to additional opportunities by which the Society may speed the war effort will be deeply appreciated.

(*Signed*) H. V. COES,
President, A.S.M.E.

Woman's Auxiliary

The Council accepted with sincere thanks the annual report of the Woman's Auxiliary and asked the president to write a letter of appreciation of the work of the Auxiliary.

Postwar Planning

A Committee on Society Program for Postwar Planning, consisting of J. N. Landis, chairman, W. D. Ennis, and A. R. Cullimore, presented a report in which it was recommended:

1 That the Society should give consideration to the impact of postwar conditions on its finances, membership, section activities, student-branch activities, and employment service.

2 That the Council should recommend to the professional divisions and local sections that special effort be made to fill national and local programs with material on new technical developments.

3 That the editor should be encouraged to include in MECHANICAL ENGINEERING information on postwar planning as it affects engineering and particularly mechanical engineering.

The report was accepted, the committee was continued, and the secretary was asked to call the attention of committees involved to the specific recommendations.

Constitution and By-Laws

The Council received for first reading proposed changes in By-Law 5, Par. 9, relating to fees and dues, and to By-Law 14, Par. 16, relating to financial procedure.

The Council voted to amend Article R7, Rule 5, on the election of directors, and Article R15, Rules 1, 2, and 3, on professional practice.

Radio Broadcasts

A report of the Joint Committee on Radio Broadcasts which arranged and carried through a series of broadcasts during the year on "The Engineer at War" was accepted with sincere appreciation.

Visits of Council Members

Members of the Council reported on visits made by them to the local sections and student branches since the June meeting. Emphasis was laid on the necessity for improving the effectiveness of the Local Sections Delegates Conferences. Representatives from the Group Delegates Conference, in session in an adjoining room, were invited to meet with the Council to discuss this and other matters and H. T. Avery, A. M. Selvey, and B. G. Elliott were designated by the Conference to represent it with the Council. As a result of the comments of these representatives, members of the Council were informed of the attitude and opinions of the Group Delegates Conference and were assured that the matters over which the Council had expressed concern were being considered by the Conference.

Percy Nicholls Award

The Council approved the joint award by the A.S.M.E. Fuels Division and the A.I.M.E. Coal Division of the Percy Nicholls Award, and authorized the A.S.M.E. representatives to participate in the raising of the necessary funds.

Inter-American Co-Operation

The secretary reported a communication from Willis R. Woolrich suggesting discussion by the Council of "a program for the Department of State on relationships with Latin-American countries through science and engineering." It was stated that the A.S.M.E. has a Joint Committee on Inter-American Engineering Co-operation on which A. M. Greene, Jr., is its representative. The committee is engaged in certain activities.

Orville Wright Honored by I.M.E.

It was announced that Orville Wright had been elected an honorary member of The Institution of Mechanical Engineers" in recognition of his distinguished contributions to mechanical science."

The secretary also announced that the Society had been asked to name a representative to be present at the presentation of the James Watt International Medal of The Institution of Mechanical Engineers to A. G. M. Michell, on Jan. 22, 1943.

World Power Conference

The Council accepted the invitation of the executive committee of the World Power Conference to designate the A.S.M.E. president in office each year to serve as ex-officio member of this executive committee.

Concluding Session of 1942 Council

The concluding session of the 1942 Council, under the chairmanship of James W. Parker, president A.S.M.E., was held in the rooms of the Society on Friday, December 4. There were present: A. G. Christie, H. N. Davis, and W. H. McBryde, past-presidents; S. B. Earle, K. M. Irwin, C. B. Peck, E. B. Ricketts, and W. R. Woolrich, vice-presidents, W. G. Christy, H. O. Croft, H. L. Eggleston, J. W. Eshelman, Linn Helander, G. E. Hulse, T. S. McEwan, and G. T. Shoemaker, managers; C. E. Davies, secretary; Harold V. Coes, president-elect; T. E. Purcell, W. J. Wohlenberg, R. W. Morton, and A. E. White, members of Council elect; S. R. Beitler (Constitution and By-Laws), N. E. Funk (Meetings and Program), and W. A. Carter (Professional Divisions); W. S. Gleeson, W. H. Larkin, and R. M. Matson, local sections' delegates; H. D. Strong, Jr., and W. Wiitanen, junior observers; A. A. Potter, guest, R. L. Sackett, assistant to secretary; and George A. Stetson, editor.

The following actions are of general interest:

A cablegram received from Harry R. Ricardo expressing his gratification at being elected an honorary member of the A.S.M.E., was read.

Membership Program

The comprehensive suggestions of the secretary relating to a membership development program were referred to the 1943 Council. [The 1943 Council voted to adopt the proposed procedure.]

Engineers' War Board

The Council voted to discharge the Engineers' Defense Board and to approve the establishment of an Engineers' War Board. The working out, with representatives of other engineering societies, of a plan of organization of the new Board and the preparation of a statement of its scope, for presentation to the Council, was referred to the A.S.M.E. War Production Committee.

"Journal of Applied Mechanics"

A request for additional funds with which to enlarge the scope and usefulness of the *Journal of Applied Mechanics* was discussed and referred to the Executive Committee of the Council.

Group Delegates Conference

R. M. Matson, Speaker for the Conference of Group Delegates of 1942, summarized the actions of the Conference, and the Council asked the secretary to convey to each delegate the Council's appreciation of his services. The recommendations of the Conference were referred to the Society committees involved.

Steam Turbines

On recommendation of the Committee on Power Test Codes, it was voted to appoint a committee to give further consideration to the standardization of steam turbines.

Engineering Students

A. A. Potter presented a resolution, signed by 31 members of the Society, recommending adoption of a resolution on the deferment of engineering students. After discussion the following resolution, for transmission to the President of the United States was accepted:

WHEREAS, technically trained engineers are indispensable to modern mechanized warfare and are needed in greater and greater numbers by the armed forces and by the war industries and will be equally essential to the rehabilitation program,

Therefore, be it resolved that the Council of The American Society of Mechanical Engineers, acting on behalf of the membership of the Society, at the Sixty-Third Annual Meeting of the Society held in New York, November 30 to December 4, 1942, is convinced that the effective prosecution of the war effort demands that an adequate supply of engineers be insured for the armed forces and the war industries through the deferment of certain students in engineering colleges under the following conditions:

(1) Enrollment in a college with a curriculum professionally accredited by the Engineers' Council for Professional Development.

(2) Completion of not less than one term or one semester's work in an accredited professional curriculum in engineering with an average scholastic grade at least equal to that required for graduation.

Retiring Council Members

Appreciation of their services was voted to members of the Council whose terms expired December, 1942: James H. Herron, Samuel B. Earle, K. M. Irwin, Frank H. Prouty, Edwin B. Ricketts, Linn Helander, and James W. Parker.

War Production Committee

The Council voted to extend to the War Production Committee and particularly to its chairman, Col. James L. Walsh, sincerest appreciation for the work being done.

There being no further business, the 1942 Council adjourned and the 1943 Council was called to order by James W. Parker, who presented the gavel of office to President Harold V. Coes.

Appointments

C. E. Davis was reappointed secretary of the Society for the year ending with the Annual Meeting, 1943, and W. D. Ennis was reappointed treasurer. The secretary's leave of absence was continued.

The constitution of the Council for 1943 was announced and the appointments to special and standing committees were confirmed. These appointments will be included in the Society Records, Part 1, which will be published in February. Various special committees were reviewed and continued.

The Executive Committee for 1943 will consist of Harold V. Coes, chairman, Clarke Freeman, George E. Hulse, Clair B. Peck, and A. R. Stevenson, Jr.

1943 Society Meetings

Approval was voted of the holding of the 1943 Spring Meeting at Davenport, Ia., April 26–28, and the 1943 Annual Meeting in New York during the week of November 29.

"Journal of Applied Mechanics"

The Council approved recommendations of the 1942 Council on the proposal to expand the usefulness of the *Journal of Applied Mechanics*.

Professional Divisions and Local Sections

The following resolution, adopted by the Committees on Professional Divisions and Local Sections, was approved.

RESOLVED: That in order to develop and implement more active co-operation between the Local Sections and Professional Divisions, the Standing Committee on Professional Divisions recommends that the Society study ways and means of accomplishing this, and the Council is asked to consider providing such additional help at Society headquarters and with it the necessary funds required,

THEREFORE, it is further proposed that each of the two standing committees appoint a liaison member representative on the other's committee.

Business Meeting Approves Report of the Council

AT THE Annual Business Meeting of The American Society of Mechanical Engineers, held at the Hotel Astor on Monday, Nov. 30, 1942, the report of the Council, the Finance Committee, and other committees of the Society were presented and approved. The report of the Council and Finance Committee will be found in this issue. The reports of other committees are separately printed and may be had by applying to the secretary.

Secretary Davies explained the procedure

NOMINATING COMMITTEE FOR 1943

Group I	Representative	Chairman, B. P. Graves, Brown & Sharpe Mfg. Co., Providence, R. I.
	1st Alternate	L. C. Smith, Spencer Turbine Co., Hartford, Conn.
	2nd Alternate	C. P. Howard, 18 Davidson Rd., Worcester, Mass.
II	Representative	Theodore Baumeister, Department of Mechanical Engineering, Columbia University, 120th St. & Broadway, New York, N. Y.
	1st Alternate	G. J. Nicastro, Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
III	Representative	V. M. Palmer, Eastman Kodak Co., 1669 Lake Avenue, Rochester, N. Y.
	1st Alternate	J. S. Morehouse, Villanova College, Villanova, Pa.
	2nd Alternate	C. H. Bierbaum, 197 Lathrop St., Buffalo, N. Y.
IV	Representative	James Ellis, 1708 Orchard Lane, Kingsport, Tennessee
	1st Alternate	A. M. Ormond, Savannah Sugar Refining Corp., Savannah, Ga.
	2nd Alternate	H. G. Mouat, Whiting Corp., 830 Martin Bldg., Birmingham, Ala.
V	Representative	Secretary Warner Seely, Warner & Swasey Co., 5701 Carnegie Avenue, Cleveland, Ohio
	1st Alternate	E. R. McCarthy, 3077 Meadowbrook Blvd., Cleveland Heights, Ohio
	2nd Alternate	S. M. Weckstein, 204 25th Street, N. W., Canton, Ohio
VI	Representative	G. L. Larson, Department of Mechanical Engineering, University of Wisconsin, Madison, Wisconsin
	1st Alternate	David Larkin, 4203 North Union Blvd., St. Louis, Missouri
	2nd Alternate	W. C. Lindemann, 601 Cleveland Ave., Milwaukee, Wisconsin
VII	Representative	L. T. Hays, Box 3416, Portland, Oregon
	1st Alternate	E. P. Weiser, 7412 N. Chase, Portland, Oregon
VIII	Representative	A. L. Hill, 1033 Humboldt St., Denver, Colorado
	1st Alternate	H. L. Crain, Kansas City Power & Light Co., 115 Grand Ave., Kansas City, Mo.
	2nd Alternate	H. E. Degler, University of Texas, Austin, Texas

by which the Nominating Committee of the Society is elected and presented the report of the tellers of election which canvassed the letter ballot for officers and directors which closed at 10 a.m., September 22.

J. N. Landis, chairman of the Committee on Local Sections, then read the names of the proposed Nominating Committee for 1943. The names of the committeemen, who were duly elected, appear in tabular form on the preceding page.

President Parker spoke briefly about his experiences and the impression received in traveling on behalf of the Society during his term of office.

Gregory M. Dexter, member of the Society, addressed the meeting on the subject of the failure of the Committee on Publications to approve publication of his paper "A Case Study of Electrical Rates and Service in a Suburban Community," presented at the 1941 Annual Meeting of the Society. He presented a resolution which was not seconded. C. B. Peck, chairman of the Committee on Publications at the time formal action on Mr. Dexter's paper was taken, explained briefly the committee's point of view.

Recommendations to War Manpower Commission

THE Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission met in the Engineering Societies Building on Tuesday, December 8. R. E. Doherty, president, Engineers' Council for Professional Development and president, Carnegie Institute of Technology, is chairman of the Consultative Committee and Dr. Edward Charles Elliott, president of Purdue University, is chief of the Professional and Technical Division. At the conclusion of the meeting, Dr. Elliott authorized publication of the recommendations which the committee made to him. The recommendations follow:

The committee recommended that the War Manpower Commission undertake immediately, with the co-operation of the War Production Board, a factual survey of shortages of *professional* engineering manpower in war industries, and surpluses wherever they may exist, in order to establish a rational basis for planning a program for the most effective training and use of the limited engineering manpower. The following motion was made, seconded, and carried unanimously:

"Recognizing the necessity for a continuing flow of professionally trained men for war industries, especially for urgent developmental work in improving the quality and production of actual weapons and materials of warfare, this Consultative Committee on Engineering for the Professional and Technical Division of the War Manpower Commission, respectfully recommends that the Chairman of the War Manpower Commission immediately take the necessary steps in order to provide temporary deferment from military service for those undergraduates in recognized engineering schools who are subject to Selective Service. Such deferment is necessary pending a more thorough study of the requirements of engineering manpower both by war industries and the Armed Forces.

"This recommendation confirms and reemphasizes the resolutions made by the recent annual meetings of The American Society of Mechanical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education, and others looking to the deferment of those young men who are already in engineering training and are maintaining satisfactory academic records. This is not a recommendation for class deferment but is a recognition of a temporary but critical phase of the manpower situation which requires prompt and decisive action to prevent serious crippling of the war program."

A.A.A.S. Meeting Postponed

THE 1942 meeting of the American Association for the Advancement of Science, which was to have been held in New York during the week of December 28, has been indefinitely postponed owing to transporation difficulties. The program for Section M, Engineering, of the A.A.A.S. meeting was announced in the December issue. Plans for the holding of the meeting at some later date have not been announced.

I.S.A. Tolerance System

THE A.S.M.E. has reprinted in this country "I.S.A. Tolerance System, I.S.A. Bulletin 25," dated January, 1941. The pamphlet which is paper-bound, $8^1/_2 \times 11$ in., has 44 pages and is illustrated with diagrams and graphs. Copies may be obtained from the A.S.M.E., 29 West 39th St., New York, N. Y., for $2.50 each.

I.S.A. stands for International Standards Association which is a federation of national standards associations in which the American Standards Association holds membership.

The present edition was prepared and published by the A.S.M.E. at the request of A.S.A. Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4). It contains detailed tables of limits and fits converted from the metric system of units into inches.

The nominal size range of holes and shafts covered by the table extends from 0.04 to 19.69 in. The fits are given in the basic-hole system as well as the basic-shaft system. Tolerances are unilateral.

GEORGE F. BATEMAN PLACING WREATH ON MEMORIAL TO ALEXANDER LYMAN HOLLEY, FOUNDER A.S.M.E.

S.P.E.E. Pays Tribute to A. L. Holley

FOLLOWING a luncheon of the Middle Atlantic Section of the Society for the Promotion of Engineering Education held at the Holley Hotel in Washington Square, New York, N. Y., on December 5, members of the section paid tribute to Alexander Lyman Holley, Founder of The American Society of Mechanical Engineers, whose bust rests on the top of a stone monument situated in the Square. Dean George F. Bateman, dean of engineering, Cooper Union, hung a wreath on the monument in the presence of the members and guests of the section.

The inscription on the pedestal reads as follows:

HOLLEY

Born in Lakeville, Conn., July 20, 1832
Died in Brooklyn, N. Y.
January 29, 1882
IN HONOR OF
ALEXANDER LYMAN HOLLEY
FOREMOST AMONG THOSE
WHOSE GENIUS AND ENERGY
ESTABLISHED IN AMERICA
AND IMPROVED
THROUGHOUT THE WORLD
THE MANUFACTURE OF
BESSEMER STEEL
THIS MEMORIAL IS ERECTED
BY ENGINEERS
OF TWO HEMISPHERES

At Cooper Union during the afternoon the section was addressed by Henry T. Heald, president S.P.E.E. and president of Illinois Institute of Technology, who reviewed the developments in engineering colleges as a result of the war.

DELEGATES TO LOCAL SECTIONS CONFERENCE DURING 1942 A.S.M.E. ANNUAL MEETING
(*Front row, left to right:* J. W. Zeller, W. H. Larkin, Carl Schabtach, J. B. Jones, A. M. Selvey, B. G. Elliott, H. T. Avery, and R. M. Matson. *Back row, left to right:* F. C. Richardson, W. S. Gleeson, F. S. Erdman, W. R. Chambers, R. R. Slaymaker, C. C. Austin, and L. J. Cucullu. *Absent,* J. G. McGivern.)

Local Sections Delegates Hold Active Sessions to Discuss A.S.M.E Affairs

National Conference of Group Delegates Held During 1942 Annual Meeting of the Society

AN important feature of every A.S.M.E. Annual Meeting is the National Conference of Local Sections Group Delegates. This body consists of two representatives from each of the eight regional groups of local sections. It provides a means for transmitting to the Council of the Society ideas, criticisms, and suggestions on Society matters of all kinds, together with recommendations expressing the majority opinion of the delegates.

Regional Conferences Held First

The questions considered by the Conference originate through members of one or more of the local sections and are assembled by the agenda secretary. Regional conferences of local sections delegates are held about two months before the Annual Meeting to consider the order of business and to inform the delegates as to the wishes of the local sections in the group which they are to represent.

This year's conference was called to order at 9:50 a.m. on Sunday, November 29, by speaker R. M. Matson and continued in session all day Sunday and Monday, finally adjourning at noon on Tuesday, December 1. J. B. Jones served as secretary of the Conference, and the agenda secretary was A. M. Selvey.

The accompanying table is a complete list of delegates. The terms "one year" and "two years" indicate whether the various delegates were serving for the first or second time, since all delegates are elected for a period of two years.

President James W. Parker spoke briefly at the opening session. He discussed the many visits he recently made to various local sections and his attendance at some of the Regional Conferences, and said that he was favorably impressed by the quantity and quality of the work being done by the local sections and the intelligent interest in Society affairs shown at the Regional Conferences.

Several members of the Committee on Local Sections were present at the opening session and at various times during the Conference. F. L. Wilkinson, chairman-elect of this committee attended nearly all of the sessions. Other members present at some of the sessions were J. N. Landis, chairman, J. A. Keeth, O. B. Lyman, S. R. Beitler, and A. R. Mumford.

Secretary Davies and assistant secretary Hartford dropped in occasionally. Others who appeared for the purpose of advising the Conference on special matters were T. M. Knoop, R. L. Sackett, and J. E. Younger.

Order of Business

The order of business for the Conference contained a total of 37 items, grouped under the following eight headings: Local section activities, national society organization, publications, employment and welfare, professional development, junior members, war effort, and postwar reconstruction. Realizing the important part which mechanical engineers must play in winning the war, great emphasis was placed on the necessity for shaping all Society meetings and policies to conform to this important objective.

Considerable attention was also given to the desirability of obtaining better and more timely topics for future conferences. As a means toward this end, a procedure was outlined for obtaining agenda items from the Council, professional divisions, and standing committees as well as local sections, and for obtaining the maximum co-operation from local sections and group delegates conferences in preparing better material.

Suggest Re-Establishment of Associate-Member Grade

Another important recommendation made to the Council was the re-establishment of the grade of Associate Member with a minimum age limit of 27. The purpose of this suggestion was to provide a means of recognizing the fact that, particularly under present conditions, many young engineers have advanced to positions of responsibility which would justify their advancement to member grade were it not for the fact that they have not yet reached the required age minimum of 30 years.

Summary

These and other high lights of the Conference are summarized in the following statement submitted to the Council on December 4 by speaker R. M. Matson who headed a committee of three; the other two members were

LIST OF DELEGATES

Group	Term	Name	Section
I	1 year	J. W. Zeller, Boston, Mass.	Boston
	2 years	F. C. Richardson, New Haven, Conn.	New Haven
II	1 year	W. H. Larkin, New York, N. Y.	Metropolitan
	2 years	W. S. Gleeson, Brooklyn, N. Y.	Metropolitan
III	1 year	Carl Schabtach, Schenectady, N. Y.	Schenectady
	2 years	F. S. Erdman, Ithaca, N. Y.	Ithaca
IV	1 year	J. B. Jones, Blacksburg, Va.	Virginia
	2 years	W. R. Chambers, Knoxville, Tenn.	East Tennessee
V	1 year	A. M. Selvey, Detroit, Mich.	Detroit
	2 years	R. R. Slaymaker, Cleveland, Ohio	Cleveland
VI	1 year	B. G. Elliott, Madison, Wis.	Rock River Valley
	2 years	C. C. Austin, Chicago, Ill.	Chicago
VII	1 year	H. T. Avery, Oakland, Calif.	San Francisco
	2 years	J. G. McGivern, Spokane, Wash.	Inland Empire
VIII	1 year	R. M. Matson, Dallas, Texas	North Texas
	2 years	L. J. Cucullu, New Orleans, La.	New Orleans

W. H. Larkin and W. S. Gleeson. At the same time a detailed report was submitted giving the final action on all of the items on the agenda.

"The 1942 Local Sections Group Delegates National Conference, recognizing the efforts which individuals and local sections of the Society are expending in the war program, concentrated its attention upon those problems of the agenda which would provide maximum assistance in this program.

"The conference used as its yardstick the criterion. 'Will this suggestion make a useful contribution toward winning the war?'

"The conference recognizes the value of the Regional Conferences as a medium for the interchange of ideas and experiences among local sections delegates within a group. However it proposes a procedure by which agenda items shall be contributed by Council, professional Divisions, standing committees, and local sections. These items shall be winnowed by local sections executive committees to provide live controversial topics based, during the present emergency, upon conclusion of a quick and decisive victory; and that, should the contributed topics fail to measure up to that standard, Group and National Conferences should be suspended for the duration of the war.

"The conference recommends that the number of national meetings of the Society be placed at the minimum number which will provide the greatest aid to the war effort.

"The conference recommends the re-establishment of the Associate Member grade in order to meet the problems of the aviation industry.

"The Conference commends the work of the professional divisions and particularly the Aviation Division, the work of the codes and standards committees, and the industrial clinics sponsored by the Society in co-operation with the War Production Board.

"The conference appreciates the privilege of having the advice of a number of committee chairmen, staff members, and members of council during its sessions. The kindly suggestions and constructive information of these men are extremely helpful.

"The postwar problems present themselves for serious consideration and the conference feels that local sections, local engineering councils, and individual members are ready to co-operate with the A.S.M.E. Postwar Planning Committee and to endorse heartily and subscribe to its objective."

[The foregoing report was prepared for the A.S.M.E. News by W. S. Gleeson and G. J. Nicastro, both members of the Society.—Editor.]

Officers for 1943 Conference

Immediately before final adjournment, the Conference elected the following officers for the 1943 Conference:

Speaker, C. C. Austin; *vice-speaker*, R. R. Slaymaker; *secretary*, F. C. Richardson; *committee chairmen:* agenda, L. J. Cucullu; budget, W. S. Gleeson; membership, W. R. Chambers; organization, F. S. Erdman; and miscellaneous, J. G. McGivern.

Nineteenth Annual Meeting of the Woman's Auxiliary, A.S.M.E.

Mrs. E. C. M. Stahl President for 1943

The nineteenth annual meeting of the Woman's Auxiliary to The American Society of Mechanical Engineers was held in conjunction with the annual meeting of the parent body Nov. 30–Dec. 4, 1942, at the Hotel Astor. The general chairman, Mrs. J. N. Landis, and the vice-chairman, Mrs. G. E. Hagemann, with the assistance of Mrs. F. M. Gibson, chairman of Registration, Mrs. E. B. Smith for Program and Tickets, Mrs. R. M. Gates for Decorations, Mrs. R. B. Purdy for Annual Luncheon, Mrs. Crosby Field for Excursions, Mrs. C. H. Young for Monday Tea, and Mrs. E. C. M. Stahl for "AsKme" made the week a very enjoyable one.

Informal Tea at Women's Headquarters

On Monday some of our women attended the luncheon on "Ingenuity" and the others the luncheon at the Engineering Woman's Club where Miss Elsie M. Cane spoke on "Royal Copenhagen Porcelain and China." A successful innovation this year was the Informal Tea at the Women's Headquarters which was held on a Monday afternoon so that everyone might meet early in the week. In the evening the group enjoyed "The Firestone Hour" broadcast in Radio City.

President Coes Introduced

Tuesday morning the annual business meeting of the Auxiliary was convened at 10:30 at Hotel Astor. Mrs. F. M. Gibson, the president, presented H. V. Coes, the newly elected president of the A.S.M.E., who greeted the Auxiliary, and our sponsor, Prof. A. G. Christie, past-president of the A.S.M.E., told of his work in Baltimore for the women in war work. Both Mr. Coes and Professor Christie complimented the Auxiliary on its fine work with the Student Loan Fund, which has provided loans to 59 students, and the Calvin Winsor Rice Scholarship Fund, which has given three students from South America the opportunity to complete postgraduate courses in North American colleges. We understand we are the only woman's organization which provides scholarships to South American students in order to promote friendly relations between the Americas. We were pleased to hear from our own charter member, Dr. Lillian Gilbreth, before the business of the day started.

Reports From Chairmen Read

Reports from the chairmen were read and placed on file. The reports from the sections were most gratifying. Mrs. Justin J. McCarthy, chairman of Philadelphia, Mrs. Thomas F. Githens of Cleveland, Mrs. J. Noble Landis of Metropolitan, and Mrs. Crosby Field, sponsor for Los Angeles, read the reports. Mrs. A. R. Cullimore, chairman of the Tellers, announced the election of the following officers for the year 1943. Mrs. E. C. M. Stahl, president; Mrs. Rudolph F. Gagg, first vice-president; Mrs. George W. Farny, second vice-president; Mrs. Charles M. Sames, third vice-president; Mrs. Justin J. McCarthy, fourth vice-president; Mrs. Sidney F. Duncan, fifth vice-president; Miss Burtie Haar, recording secretary; Mrs. Crosby Field, corresponding secretary; Mrs. A. H. Morgan, treasurer. Mrs. Gibson then handed the gavel to Mrs. Stahl, the incoming president who told of the happy relations of the Auxiliary and its excellent financial condition due to the leadership of Mrs. Gibson.

There was a rising vote of thanks tendered to Mrs. Gibson in tribute to her outstanding personality and her exceptional work on behalf of the Auxiliary. The meeting adjourned to the Annual Luncheon held at the Engineering Woman's Club where the women were entertained by the delightful music of Mrs. Marian Frey and Mrs. Mildred Duer Murray and the humorous experiences of Rev. Cornelius Greenway in "Hunting Big Game With a Fountain Pen."

Luncheon at Phi Gamma Delta

Wednesday morning the group saw a preview of an unreleased film and then enjoyed luncheon at the Phi Gamma Delta Club. Later some played cards and others visited the Waldorf Astoria Hotel before attending the Annual Dinner and Honors Night and the President's Reception at the Hotel Astor. We were much pleased that President Parker spoke of the work of the Auxiliary in complimentary terms.

Thursday morning the women braved a cold wind to see the New York sky line from Staten Island Ferry and to visit Seamen's Church Institute—always an inspiration—where a tasty lunch was eaten. Later in the afternoon, tea was served at the Son of the Sheik in the Syrian manner.

20th Anniversary Next Year

The women voted this year's annual meeting a happy one and we are looking forward to next year's celebration of the 20th anniversary of the founding of the Auxiliary.

Burtie Haar

MANAGEMENT DIVISION LUNCHEON ON TUESDAY AT THE ASTOR

(Mrs. George E. Hagemann, Mrs. Leon P. Alford, and Dr. Lillian M. Gilbreth.)

United Engineering Trustees, Inc. Report for 1941-1942

Summary of Facts Concerning Finances, Building, Engineering Societies Library, and Engineering Foundation

THE Annual Report of the United Engineering Trustees, Inc., for 1941–1942, was issued on October 22, 1942, by President Albert Roberts. Mr. Roberts' report, in somewhat abridged form, follows:

The entry of our country into the war shortly after the beginning of our last fiscal year has created additional problems and difficulties in the conduct of the affairs of the corporation.

A considerable program of renovation of the Engineering Societies Building was under way, supplies for which became subject to war priorities, and prices rose on those materials which were obtainable. However, the work was sufficiently advanced so that, despite some delay, it was completed during the year at a moderate increase in cost over the original appropriations. Results have been very gratifying both to the occupants and to the board.

The operating financial position was adversely affected, in that labor costs and operating material costs have risen and income from rental of halls and auditorium has decreased, as these have been largely used for educational meetings attended by younger men, many of whom are now engaged in the war effort. These adverse effects will be greater in the ensuing fiscal year.

Financial

Financial conditions and security prices suffered further dislocations during the year, and new problems have arisen. Nevertheless, our security holdings, under the management of the Finance Committee, with the cooperation of our financial advisers, have improved in quality. The financial position and the results of the year's operations are shown in the accompanying summarized financial report. The accounts have been audited by Haskins & Sells, and their certificate is included in the complete report.

As in the past year, all securities are held by the Chemical Bank & Trust Company as custodian.

The Depreciation and Renewal Fund at the end of the year stood at $434,239.48, after receipt of the appropriation of $20,000 from operations, as for some years past, and the income from its investments, less outlays for renovation and improvement made during the year, totaling $41,496.75.

The corporation acts as treasurer for the Engineers' Council for Professional Development and is custodian of the relief funds of Engineering Societies Personnel Service, Inc., and funds of the John Fritz Medal Board of Award and of the Daniel Guggenheim Medal Board of Award; also of contributions from outside organizations aiding researches by the Engineering Foundation.

Engineering Societies Building

During the summer of 1941 renovation had been started in various parts of the building which after thirty-five years of service to the societies required repairs or renewal. This work was retarded by the increasing difficulty in obtaining materials, and completion ran well into 1942. One of the most striking improvements was the elimination of the false skylight illumination in the auditorium and the substitution of a safer means of providing more pleasing and more even illumination of adequate intensity.

Additional expenditures beyond the budget were incurred during the year in the amount of approximately $2000 for the purchase of war-damage insurance on the building and for fire-fighting and safety equipment which under civilian-defense laws became mandatory. In addition, maintenance supplies were purchased ahead as available, which increased the year's expenditures but which should reflect a corresponding decrease in the coming year.

On the income side, revenue from the meeting halls fell about $2000 short of expectations owing to cancellation of scheduled meetings and classes due to war conditions. We heartily urge that the societies utilize their building to the maximum of their requirements, and thus augment our income.

Insurance inspectors report the building is in excellent physical condition. We were fortunate in having the fire-insurance rate on the building further reduced, the resulting rates being the lowest given to any property of its class. Fire, extended coverage, liability, and compensation insurance are carried, to which was added, on July 1, war-damage insurance.

All available space in the building is occupied by the Founder Societies and Associates.

Consideration for the Future

The 1941 annual report recorded that the opinions of architects obtained at that time made it evident that the cost of major changes in the building to make it more nearly meet the present needs would not be justified by the possible benefits.

In pursuit of this general subject an extensive review of the condition and value of the building and property in relation to the depreciation and renewal fund has recently been concluded and report has been transmitted to the Founder Societies.

The time will come when, the war and ensuing readjustments being over, you may feel warranted in replacing the present quarters with new quarters. The roster of the four societies includes many, if not the majority, of those largely responsible for the creation and operation of all the basic facilities of our modern life, from the production of the necessary raw materials to final utilization and operation in their finished form. With this talent available it would seem that only

SUMMARIZED FINANCIAL REPORT, SEPTEMBER 30, 1942

FUNDS AND PROPERTY

Combined Fund:* Summary of Investments, September 30, 1942

FUNDS INCLUDED		Book value	Market value
Engineering Foundation Fund		$ 863,532.93	
Edward Dean Adams Fund		87,633.85	
Library Endowment Fund		162,273.06	
Depreciation & Renewal Fund		434,239.48	
General Reserve Fund		9,825.15	
Total		$1,557,504.47	
Investments: "Legal"	$ 471,654.22		
Nonlegal	1,002,569.00		
Total investments, Sept. 30, 1942	1,474,223.22		$1,384,998.25
Cash uninvested	11,237.56		
Savings Bank Accounts	72,043.69		
	$1,557,504.47		
Real-estate (Less Depreciation & Renewal Fund Res.)		$1,559,554.44	
Henry R. Towne Engineering Fund Investments		44,633.13	28,278.02
Henry R. Towne Engineering Fund Uninvested Cash		171.30	
The Daniel Guggenheim Medal Board of Award Investments		15,604.28	7,447.32
The Daniel Guggenheim Medal Uninvested Cash		235.72	
The John Fritz Medal Board of Award Investments		3,500.00	3,762.50
United Engineering Trustees, Inc., Operating Assets		1,201.04	
Engineering Societies Library Maintenance Assets		16,857.67	
Library Service Bureau Reserve Fund Investments		7,500.00	7,350.00
Gift for Endowment Committee Cash		474.94	
The Engineering Foundation—unexpended income		24,922.69	
Alloys of Iron Research—unexpended income		6,286.75	
Welding Research—unexpended income		3,802.10	
The Engineering Foundation Custodian Fund Cash		10,212.91	
United Engineering Trustees, Inc., Custodian Funds—unexpended income		2,476.74	
		$3,254,938.18	

* A group of funds managed as one for convenience and economy in investment transactions.

organization is needed in order to achieve this end.

Engineering Societies Library

In his annual report to the Library Board, Harrison W. Craver, director, Engineering Societies Library, New York, N. Y., stated:

The past year has been one of unusual activity, during which our work has reflected directly the burdens placed upon engineers by military needs. The inquiries have been many and varied; most of them have called for the quickest possible answers, and many, unfortunately, asked for information so recent that it was not yet in print. As in the preceding year, a notable feature was the extent to which engineers have been detached from their customary fields of work and are being compelled to orient themselves in new ones.

To these men the library has offered help to the extent of its possibilities. Book lists have been supplied and books have been lent. Much periodical literature has been cited and copied. Where inquiries fell outside the scope of our work, an endeavor to suggest other sources of information was made.

An outstanding event of the year has been the use made of the library by the military authorities. There has scarcely been a day when members of government bureaus were not engaged in research work here, and the advice of the staff has been constantly sought in sources of information and methods of searching. Loans to government departments have been numerous. In addition, our chief indexer has been lent to a government bureau to assist in devising a permanent system of indexing for military purposes.

It has been a source of great satisfaction to find how satisfactorily the collection meets the calls upon it. Our large collection of foreign periodicals has proved very valuable and our catalog has answered requirements very effectively. A considerable number of periodicals appear to be available in very few other places.

During the year fluorescent lamps were installed in the reading room, with marked improvement. The lighting at night is now thoroughly satisfactory. In January, work was begun upon a Japanese-English technical glossary, with the aid of a grant from the Rockefeller Foundation. The want of such an aid to translators has long been felt by your director, and the lack of such a glossary has been felt acutely since the outbreak of war with Japan. Work is being pushed as rapidly as possible, but will probably require another year for completion.

During the year 23,734 persons have visited the Library and 11,648 others have made use of it in other ways. Searches to the number of 103 have been made and 35 translations have been prepared. Photostats to a number of 31,254 and 64 microfilms were made for 3046 persons. Telephone requests for assistance numbered 6097 and mail inquiries 1717.

It is worthy of note that the use from a distance is 32 per cent, that is, about every third user does so from a distance. In 1941 this figure was 28 per cent and it has been growing steadily for a number of years. It is gratifying to see this increasing appreciation of the service by those at a distance, unable to visit the Library.

To encourage this use, the rules governing loans to members were liberalized still further. An increase of loans of 25 per cent above 1941 resulted.

Acquisitions

While the publication of technical books in this country has greatly increased, the great part of this output has been books for mechanics and not for engineers. With foreign book sources cut off, the number of desirable books has been decidedly less. Receipts during the year were 10,163 books, pamphlets, etc. Of these 5523 proved desirable accessions and were added to the permanent collection.

As in previous years, many gifts were received from members and other friends, to whom sincere thanks are tendered. The estate of John Hays Hammond presented a large collection of periodicals and reports on mining and geology. The Library of the Massachusetts Institute of Technology presented a valuable group of bridge specifications. Many gifts have come from the National Research Council and the Society of Automotive Engineers. Sanderson and Porter, and Newell, Spencer, and Safford donated useful engineering material. A large library was received from the estate of William T. Wallace. Dr. D. B. Steinman presented the original manuscript of "Bridges and Their Builders" by D. B. Steinman and S. R. Watson.

The Library has continued to receive frequent substantial gifts from the editorial departments of the McGraw-Hill Publishing Company. It has also had hearty co-operation from many national associations of engineers and industrialists.

The number of books reviewed for the journals of the Founder Societies was 498.

Book Stock

On October 1, 1941, the Library contained 152,263 volumes, 7755 maps, and 4492 searches. Corresponding figures at the end of the fiscal year 1941–1942 are 154,770 volumes, 7845 maps, and 4525 searches, a total of 167,140 items.

Continued efforts to dispose of duplicates by gift to other libraries or by sale have reduced the number to about 11,000 volumes and pamphlets.

Periodical Index

About 20,000 cards were added to this index, which now contains over 276,000 carefully classed references to articles on all branches of engineering.

Finance

The budget established for general operation was $46,137, of which amount $37,636.92 was provided by the Founder Societies, on a membership basis, as follows:

American Society of Civil Engineers	$ 9,943.92
American Institute of Mining and Metallurgical Engineers	8,074.68
American Society of Mechanical Engineers	9,356.88
American Institute of Electrical Engineers	10,261.44
	$37,636.92

Expenditures from this budget were $43,864.04, of which $7439.69 was spent for books and other equipment of permanent value.

Service Bureau receipts for special service were $11,398.45. Its expenses were $9749.58.

The Engineering Foundation

The Engineering Foundation, established in 1914, completed its twenty-eighth fiscal year on September 30, 1942.

The accompanying financial statement summarizes the present capital funds of the Foundation, the income, and expenditures during the year. The book value of the capital funds of the Foundation on September 30, 1942, was $952,000, a slight reduction from that of a year previous. The income has continued to suffer reduction due to lower prevailing interest rates. As a partial offset to this loss of income, it has been possible to reduce administrative and general expenses materially.

It has been the policy of the Foundation for many years to contribute to a considerable number of projects in diverse fields of engineering. This policy has been continued, but projects have been reconsidered with regard to their bearing on the war and have been encouraged only in so far as they appear to contribute to the war effort. In several cases, grants which have been provided have not been fully utilized because of withdrawal of personnel to more direct war activities. It is expected that this trend will continue during the course of the war, and on that account it may be impracticable to make full use of the Foundation's income on projects helpful to the national cause. This is particularly the case in view of the Government's willingness to support research projects which can be demonstrated as important to the war effort.

During the year, work has progressed on fifteen projects, comprising twenty-one separate problems, including the following in which the A.S.M.E. is particularly interested:

Effect of Temperature on the Properties of Metals

Project No. 45. Grant, $1000. Chairman, Norman L. Mochel, Lester Branch Post Office, Philadelphia, Pennsylvania.

During the past year, the Joint Research Committee on Effect of Temperature on the Properties of Metals under the sponsorship of The American Society of Mechanical Engineers and the American Society for Testing Materials, held one meeting on December 2, 1941, at New York, N. Y. A second meeting of the committee was held in June, 1942, in Atlantic City, N. J., prior to the presentation of their report at the annual meeting of the American Society for Testing Materials. Several meetings of project committees have been held during the year.

Project No. 10 on Tubular Members Subject to Internal Pressures (H. J. Kerr, chairman). The work covered by this project, carried out at the Massachusetts Institute of Technology, has been completed, and it is anticipated that the report will be published in the near future by The American Society of Mechanical Engineers.

Project No. 16 on Relaxation (E. L. Robinson, chairman). This project is inactive at present. It is planned to sponsor a technical session on this subject at a more convenient time.

Project No. 18 on Effect of Variables on the High-Temperature Properties of Metals (H. W. Gillett, chairman). Much of the creep equipment at Battelle Memorial Institute that has been utilized in the work of this project is now assigned to other important studies, and the completion of this project must be postponed.

Project No. 25 on Comparison of Short-Time Test Methods (J. S. Worth, chairman). This project involves the comparison of results from a number of short-time test methods with those from long-time creep tests on two steels, the 0.35 per cent carbon steel K-20, and a carbon-molybdenum steel K-22. The creep test results for the steel K-20 are being taken from the many published results of tests on this steel; for the carbon-molybdenum steel K-22, creep tests at 850 F and 1000 F have been completed at the University of Michigan. A number of laboratories are co-operating.

Despite the war conditions, the project committee has made real progress, and a report is now in course of preparation.

Project No. 26 on Test Methods (J. W. Bolton, chairman). The committee has studied the Tentative Method of Test for Short-Time High-Temperature Tension Tests of Metallic Materials (E 21-37T) and will shortly recommend that this be changed to Recommended Practice for Short-Time Elevated Temperature Tension Tests of Metallic Materials.

Critical Pressure Steam Boilers

Project No. 50. Grant, $500. Chairman, Prof. H. L. Solberg, Purdue University, Lafayette, Indiana.

The Corrosion of Unstressed Steel by High-Temperature Steam. An investigation covering the corrosion of unstressed steel specimens and various alloys by high-temperature steam has been completed as originally planned. The results of this phase of the program were presented in a paper at the Fall Meeting of The American Society of Mechanical Engineers at Louisville, Ky., October 12–15, 1941. Subsequent to the meeting the paper was published in the Transactions of the A.S.M.E., vol. 64, May, 1942. Parts of this published paper were printed in the *Journal of the American Society of Naval Engineers*, November, 1941; and in *the Valve World*, April, 1942.

The data showed the effects of the following: Various types of surface finish, methods of scale removal, exposure to steam at 1100 F for various intervals of time up to 2000 hours, exposure for 500 hours at steady steam temperatures from 1000 F to approximately 1400 F, and temperature fluctuations on the corrosion resistance and spalling of scale on round bars, as well as on convex, concave, and flat surfaces. Data on the corrosion of cast steels and special alloys were given. It was found that the resistance of alloy steels to high-temperature steam is greatly influenced by the amount of chromium present. Alloy steels containing 7 per cent or more of chromium were found to be very resistant to corrosion produced by steam at temperatures up to at least 1400 F. The 18-8 stainless steels showed practically no corrosion when subjected to steam up to 1400 F.

Corrosion of Stressed Alloy-Steel Bars by High Temperature Steam. Extensive apparatus was constructed to permit measuring the effect of stress upon the corrosion of alloy steels by high-temperature steam. The apparatus consisted of a primary gas-fired superheater, a secondary electric superheater, vertical test section holders, and a loading device.

A detailed description of the equipment, procedure, and the results of tests for 1000 and 2000 hours was presented in a paper at the Semi-Annual Meeting of the A.S.M.E. in Cleveland, Ohio, June 8–10, 1942.

Data were presented showing the effect of stress upon the corrosion of Carbon-Moly, 1.25 Cr-Moly, 2 Cr-Moly, 7 Cr-Moly, 9 Cr-Moly, and 18-8 stainless-steel samples. Within the range of the test conditions, stress did not influence the penetration or corrosion due to high-temperature steam and had little effect upon the physical properties of the steels. No intergranular attack took place except for a small amount in the case of Carbon-Moly steel during a 2000-hour test. The chromium content increased the resistance of the steels tested to the corrosion by high-temperature steam.

The Dynamic Viscosity of Nitrogen. Tests have been completed on the determination of the viscosity of nitrogen gas up to temperatures of 900 F, and pressures of 1000 psi. The results have been assembled in the form of a paper which is ready for publication.

It may be of interest to add a word as to plans for future researches.

Future Test Program. Because of recent industrial developments involving the use of superheated steam at unusually high temperatures, additional corrosion tests on unstressed steel specimens at steam temperatures between 1400 and 1600 F are now in progress and will be completed before the end of the present year.

Through the co-operation of various manufacturers and users of alloy steels a series of stress rupture tests in high-temperature steam atmospheres will be conducted during the next two years. The data obtained should be of considerable value in design work.

Through funds made available by The Engineering Foundation, a study is being started which will cover the heat flow and metal temperature differences for the case of waterwall tubes under high rates of heat input and high steam pressures.

Rolling of Steel

Project No. 68. Grant, $1000. Chairman, A. Nádai, Westinghouse Research Laboratories, East Pittsburgh, Pa.

Cold Rolling of Steel. (*a*) This investigation is being carried on by C. W. MacGregor at The Massachusetts Institute of Technology and it is expected that the report upon this project will be submitted to The American Society of Mechanical Engineers for presentation and publication at their Annual Meeting in 1942.

Friction of Lubricated Surfaces at High Pressures. (*b*) In the spring of 1941 a project was submitted by R. B. Dow, professor of physics then connected with The Pennsylvania State College, for carrying out an investigation on the viscosity of certain lubricants at high pressures. A grant from The Engineering Foundation in the amount of $800 was made available for 1941–1942. Last September, Dr. Dow informed the special research committee that he had accepted a new position at the Aberdeen Proving Ground, Ordnance Office, U. S. War Department, and he could not carry out the contemplated investigation at The Pennsylvania State College.

Dynamic Characteristics of Materials

Project No. 81. Grant, $1000. Chairman, Prof. B. J. Lazan, The Pennsylvania State College, State College, Pa.

The work during the first part of the year is summarized in The American Society of Mechanical Engineers' preprint entitled "Some Mechanical Properties of Plastics and Metals Under Sustained Vibrations." This paper was presented before the Society at a session on plastics on June 8, 1942, during the A.S.M.E. Semi-Annual meeting in Cleveland, Ohio.

It is interesting to note that the *current work* and the *future plans* have an important bearing on war activities.

Current Work. Since June, 1942, the two projects listed below have been started.

(1) Development of a new, small-capacity (±3000 lb) compact direct-stress fatigue machine, especially suitable for testing structural plastics. The machine which employs the hypocyclic oscillator is now being calibrated and will shortly be used for preliminary fatigue tests. After this machine is completely developed the effect of the type of testing machine on the observed fatigue strengths of plastics will be investigated.

(2) Static and dynamic creep of a canvas laminated phenolic plastic. Static tensile creep tests on a structural plastic (the same material now being used for wing tabs in the Martin bomber), have been in progress for four weeks. The creep characteristics of specimens at seven different stresses are being studied simultaneously. The apparatus is now complete and tests are started on dynamic creep. A constant direct alternating stress is superimposed on an average static tensile stress by an oscillator and the creep is measured microscopically. The accelerating effect of vibrations on creep will be determined.

Future Plans. Improved mechanical properties and molding technics of plastic plywood and also the emergency scarcity of light metals have dictated a greater utilization of structural plastic plywood in aircraft. However, adequate knowledge on the dynamic behavior of these materials is lacking, a situation which the planned research program is designed to relieve. The research program now being formulated may include some or all of the following tests:

(1) Comprehensive study of the behavior of a completely assembled, small, plastic-plywood trainer airplane under many modes of sustained vibrations which may occur in actual flight. The vibration response characteristics of an assembled trainer will be determined. Motor vibrations will be simulated by placing an oscillator in the motor housing to produce known oscillatory force. The amplitude of vibration at critical positions in the airplane will be measured. The vibration

response under various types of alternating forces and torques for several frequencies will be determined.

The specific data yielded by the study will be a summary of the natural frequencies under various important modes of vibration and the corresponding damping capacities. Both dynamic characteristics will be evaluated simultaneously by the sustained, near-resonant vibration method. Aircraft members to be studied will include the wings (bending and torsion), tail assembly (bending and torsion), and propeller (bending in two directions).

Finally, after the foregoing nondestructive tests have been completed a series of destructive fatigue tests will be undertaken. Various parts of the airplane such as the wings, propeller, fuselage, and tail will be fractured under the most important vibrations for which the particular part is subjected in service. The fatigue strengths at an estimated 100,000 cycles of stress will be determined. The nature of the fatigue failures of the structural assemblies will be studied to suggest improvements and redesign.

The use of a completely assembled plane for the foregoing investigation, rather than the individual wings, tail, or propeller, is preferred since end conditions of the individual parts may greatly affect the vibration response characteristics. If a complete airplane is unavailable then similar tests will be performed on the various aircraft parts, assemblies, and subassemblies.

(2) Direct-stress fatigue tests (to secure the complete *S-N* curves) of structural plastic plywoods. A special, newly developed ±3000-pound fatigue-testing machine will be available for these tests which may be carried out simultaneously with the foregoing dynamic tests on aircraft parts.

Unsteady-Heat-Flow Investigations by Electrical Analogy

Project No. 89. Grant, $500. Chairman, Prof. Carl F. Kayan, Columbia University, New York, N. Y.

The research project sponsored by the Heated and Cooled Enclosures Subcommittee of the Heat-Transfer Division, A.S.M.E., has been carried on at Columbia University under V. Paschkis as "Unsteady-Heat-Flow Investigations by Electrical Analogy."

This project is an attempt to solve certain heat-flow problems by studying electrical flow in electrical networks to which the same general mathematical equations apply.

The first problem is to determine the accuracy of the method as affected by the choice of the number of electrical sections set up to represent a solid heat-flow path subjected to unsteady thermal conditions.

More fully, in the unsteady-heat-flow investigations by electrical analogy, an equivalent electrical system is set up to represent the thermal system since heat flow is analogous to electrical flow and the same general mathematical equations apply. For steady heat flow the temperature drop through a solid material varies with the length of the thermal path, (i.e. thermal resistance), just as, with electrical flow, the voltage drop varies with the electrical resistance. However, for transient or unsteady heat flow, the question of the thermal storage capacity of the solid material comes up, and it is obvious that the temperatures achieved throughout a solid mass must thus vary with time. Therefore, to complete the electrical analogy, it is essential to have the counterpart of the storage effect and this is brought about by the use of electrical condensers. Thus the electrical analogy requires the setting up of a series of electrical resistances to represent the heat-flow path, with electrical condensers of proper value tapped in at the mid-points of the electrical resistances to represent the heat-storage effects of each of the resistance sections. It is necessary to determine what number of resistor-condenser groups or sections are required to adequately represent a solid-wall heat-flow path, so that electrical potentials as determined at the resistance terminal points will adequately represent the temperature values.

The study for a one-dimensional system has been undertaken during the past research period (October 1, 1941, to September 30, 1942) and is to be followed by a study of two-dimensional systems in the coming year. It is expected that the results of the one-dimensional system will be offered for publication some time in the near future.

A.S.T.M. Issues New Standard Specifications

THROUGH action of its Committee E-10 on Standards which in the interval between meetings can act for the Society and which must approve all emergency standards, the American Society for Testing Materials has recently issued some 32 new standard specifications and test methods. Of these, 13 are emergency specifications and tests designed to expedite procurement or conservation of critical or strategic materials. All of these new specifications are being printed in separate pamphlet form (the emergency specifications on pink stock) and copies can be obtained at 25 cents each from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa. They will also be bound in the 1942 A.S.T.M. Book of Standards now in preparation.

Emergency specification carrying the designation ES-20 covers malleable-iron flanges, pipe fittings, and valve parts including parts to be assembled, manufactured in advance, and supplied from stock by the manufacturer or distributor.

Twelve of the emergency specifications as developed by A.S.T.M. Committee C-16 on Thermal Insulating Materials cover various types of thermal insulating material in different forms and for service at widely varying temperatures ranging from surface temperatures of 200 to 1900 F depending on type of materials.

Approval has been given to modification in the emergency specifications for carbon-chromium ball- and roller-bearing steels, ES-5, the changes permitting nickel and molybdenum contents of 0.35 and 0.08 per cent, respectively, these being considered residual alloys; and requirements on maximum permissible decarburization and surface defects for wire and rods for cold-heading are modified.

Emergency alternate provisions which can be invoked by the purchaser where considered satisfactory have been established in some 22 additional A.S.T.M. specifications, notably in the field of pipe and tubing. Many of the widely used specifications for boiler and superheater tubes, still tubes for refineries, and heat-exchanger and condenser tubes are affected, since changes in chemical composition conserve critical alloys and other changes will expedite procurement and increase production.

An important emergency provision in the specification covering carbon-steel forgings for locomotives and cars (A236) includes two new higher-strength classes with tensile ranges from 100,000 to 130,000 psi and elongation from 13 to 18 per cent.

Study of Cast Iron in Elevated-Temperature Operation

IN accordance with the usual policy of relieving overburdened industries by encouraging the use of more readily available substitute materials whenever possible, the War Production Board has approved a field research project to study the possibility of utilizing cast iron in operations at elevated temperatures (in excess of 450 F). This program is being conducted by the War Metallurgy Committee, National Academy of Science, Washington, D. C., with the co-operation of the American Foundrymen's Association. T. E. Barlow, Vanadium Corporation of America, and C. O. Burgess, Union Carbide and Carbon Research Laboratories, have been appointed to obtain the desired data. Since time is vital in a project of this type these men have requested the co-operation of industry in locating specific applications in which cast iron is being or has been used, successfully or otherwise, at temperatures in excess of 450 F. The information obtained during this study will be reported statistically and the actual details of operation will be kept confidential when desired.

Engineers, foundrymen, field servicemen, and others who have information on performance records of cast iron at elevated temperatures can make a valuable contribution to the ferrous industry and the war effort by contributing their knowledge and experience to this study. Detailed information or suggestions as to possible sources of such information, pertinent to the subject, should be sent to either: T. E. Barlow, 2440 Book Bldg., Detroit, Mich., or C. O. Burgess, 4625 Royal Ave., Niagara Falls, N. Y.

W.P.B. Prohibits Overmotoring

A PURCHASER of an electric motor must show that the horsepower of the motor he is applying for is no greater than that required to do the job, according to a provision in General Conservation Order L-221, announced by the Director General for Operations, of the War Production Board.

Officials of the General Industrial Equipment Division pointed out that it has been the practice of industry for many years to "overmotor," that is, to apply greater motor capac-

ity than necessary for the job to be done. As a means of stopping this practice, the order applies certain measurements by which the actual power requirements may be related to the horsepower of the motor applied for by the purchaser.

L-221 prohibits the delivery or acceptance of motors, unless they comply with certain standard specifications and are of the simplest practicable, mechanical, and electrical design. It also requires the purchaser to certify and show reason why he must have a motor of a special type; and it restricts the use of such special types to the conditions and the purposes for which they are required. For example, it limits the use of explosion-proof motors to hazardous locations.

One of the important conservation provisions in the order applies to both motors and generators. It requires the applicant to certify that he has made every reasonable effort (1) to adapt idle motors or generators in his possession, (2) to obtain used ones for his purpose, and (3) to repair or recondition his existing equipment.

Where used equipment cannot be secured within a reasonable time by the applicant, it is suggested that he make his needs known to W.P.B.'s Surplus Used Equipment Branch, which will assist him in meeting them.

It is estimated that the conservation and simplification provisions in the order will save in one year about 15,000,000 lb of copper, 55,000 tons of carbon steel, and 150,000 lb of stainless steel.

The order became effective Dec. 10, 1942.

Smaller War Plants Division of W.P.B. Completes Operating Organization

THE Smaller War Plants Division of the War Production Board has completed its operating organization and, except for two appointments in the field, now has the staff necessary to carry out its work.

In explaining the organizational chart of the Division, Lou E. Holland, head of the Division and Deputy Chairman of the War Production Board on Smaller War Plants, pointed out the distinction between the Division and the Smaller War Plants Corporation of which he is Chairman of the Board. The Corporation is a financial institution created to help smaller plants with their money problems, either in their efforts to get war orders or handle them after they do have them. The main business of the Division is to get business for the smaller plants and help them with engineering assistance to produce the goods.

Working directly with Mr. Holland on matters of policy is the Advisory Committee, the Board of Consultants, and the Representatives of Organized Labor. Abbott Smith, one of the directors of the Smaller War Plants Corporation, has been designated as Special Assistant.

Frank Smith is Deputy Director of the Division and will have direct control of the six Operating Branches. Most important of these are: The Agencies Contact Branch under O. S. McPherson, the Facilities Branch under B. T. Bonnott, and the Plant Service Branch under Leo Rush. The Agencies Contact Branch brings in the work from the procurement offices of the services, the Facilities Branch and Plant Service are responsible for the selection of the jobs to be placed, and after these job selections are made, they make the final determination of the plants which will be recommended to procurement officers.

In the Facilities Branch are three sections: (1) The Facilities Records Section, which has a general knowledge of plant capacity across the country; (2) the Critical Tools Section, which keeps constantly up to date a record of open capacity of critical tools; and, (3) a Tool and Die Service Section.

Plant Service under Leo Rush is the branch where engineering service originates. The Division receives thousands of letters asking for help in getting war work. These letters usually describe the kind of plant, the kind of work it has been doing, and the plight it is in at present. The engineers in the Plant Service Branch advise these people as to their proper course of action.

When a plant is selected to do a specific job, the engineers in the Plant Service Branch give whatever assistance is needed in connection with bidding on the job, the adaptation of machinery for the job, and help determine the best methods of production. In many plants none of this kind of service is needed; the plant is fully able to do the job unaided, but in other instances experienced guidance is useful.

Charles H. McArthur heads the Field Control Branch. All of the Deputy Regional Directors on Smaller War Plants in the twelve W.P.B. field offices and their representatives in 123 district offices report to Mr. McArthur. "In the selection of facilities to handle jobs," Mr. Holland said, "we lean heavily on the recommendations of our representatives in the field. Our Facilities and Plant Service Branches may have reason to think that a given plant is the right one for a certain operation, but usually we ask our field men to check this up on the spot before we recommend the plant to the procurement agency.

"The Co-ordination Branch under Robert Graham is responsible for the first screening the requirements brought in by the Agencies Contact Branch. Mr. Graham presides over a committee composed of engineers from the Facilities and Plant Service Branches and one or more of the men from the Agencies Contact Branch. After we have chosen the jobs we want to handle, it is the responsibility of the Co-ordination Branch to follow through and see that action is taken promptly leading up to our specific recommendations to the procurement agencies concerned.

"A good many manufacturers still come to Washington to consult with us and it is Carl Bolte's responsibility in the Interview Branch to see these people. We urge manufacturers not to come to Washington, but to see our men in the nearest W.P.B. field office. But a good many do come here anyway (and sometimes there is reason for doing so) and we try to take care of them as best we can."

H. L. Dryden to Head I.A.S.

HUGH L. Dryden of the National Bureau of Standards, Washington, D. C., member A.S.M.E., has been elected president of the Institute of the Aeronautical Sciences for the year 1943. As the eleventh president of the Institute, he succeeds Hall L. Hibbard, vice-president and chief engineer of Lockheed Aircraft Corporation, Burbank, Calif. Dryden served as chairman of the Applied Mechanics Division of the A.S.M.E. during 1942.

Dr. Dryden's work as a physicist during the past twenty-four years on the staff of the National Bureau of Standards, where he is Chief of the Mechanics and Sound Division, has produced many important developments in the sciences on which progress in aviation is based. He has been concerned chiefly with fundamental research in aerodynamics and hydrodynamics and has supervised the research done at the Bureau on aircraft structures and aircraft instruments.

Dr. Dryden delivered the annual Wright Brothers Lecture of the Institute of the Aeronautical Sciences in 1938, on the subject "Turbulence and the Boundary Layer." He was also recipient of the Sylvanus Albert Reed Award in 1940 for his notable contributions to the aeronautical sciences made through studies on the mechanics of boundary-layer flow and the interpretation of wind-tunnel experiments. His achievements in this highly technical field have greatly increased the accuracy of wind-tunnel tests on aircraft models, thus leading to improvements in design and in the prediction of performance of airplanes.

Dr. Dryden has written numerous scientific reports and papers published by the Bureau of Standards, the National Advisory Committee for Aeronautics, and technical journals. Since September, 1941, he has served as editor of the *Journal of the Aeronautical Sciences* published by the Institute.

C. H. Mathewson to Be A.I.M.E. President

C. H. MATHEWSON of New Haven, Conn., has been elected president of the American Institute of Mining and Metallurgical Engineers. Dr. Mathewson is professor of metallurgy and chairman of the Department of Metallurgy, Yale University.

The announcement made by A. B. Parsons, Secretary of the American Institute of Mining and Metallurgical Engineers, included the election of two vice-presidents: Erle V. Daveler, vice-president, Utah Copper Co., and Harvey S. Mudd, consulting engineer, Los Angeles, Calif. Six directors also elected were: H. J. Brown, consulting engineer, West Newton, Mass.; Charles H. Herty, Jr., assistant to vice-president, Bethlehem Steel Co.; O. H. Johnson, vice-president, Mine & Smelter Supply Co., Denver, Colo.; Russell B. Paul, mining engineer, N. J. Zinc Co.; F. A. Wardlaw, Jr., assistant manager, International Smelting & Refining Co.; and Felix Edgar Wormser, secretary and treasurer, Lead Industries Association.

Arthur Williams Memorial Medal Presented

THE Arthur Williams Memorial Medal for 1942, presented by the American Museum of Safety, was awarded in triplicate for three distinct lines of achievement in safe transportation, at a dinner at the Metropolitan Club, Washington, D. C., Dec. 8, 1942.

One medal was presented to Rear-Admiral Emory S. Land, "for outstanding contribution to the conservation of human life through safe construction and operation of ships."

A second award (duplicate medal) was given to W. Averell Harriman and E. Roland Harriman, "for continuing the inspiring leadership of two generations in safe transportation."

The third medal was presented to the Pan American Airways System, "for pioneer service insuring utmost safety in overseas flight." This award was received by Juan T. Trippe, president of Pan American.

G. W. Dunlap Awarded Alfred Noble Prize

THE Alfred Noble prize for 1942 has been awarded to George Wesley Dunlap, General Electric Company, Schenectady, N. Y., for his paper "The Recovery Voltage Analyzer for Determination of Circuit Recovery Characteristics," published in July, 1941, by the American Institute of Electrical Engineers. The public award of the prize will be made at the winter convention of A.I.E.E. in New York, Jan. 25–29, 1943.

A.S.R.E. Elects Officers and Directors

CHARLES R. LOGAN, representative of the Superior Valve and Fittings Company of Pittsburgh, Pa., has been elected president of The American Society of Refrigerating Engineers and was inducted into office on December 2 at the closing session of the Society's 38th Annual Meeting at the Hotel Commodore in New York City. Mr. Logan succeeds in office Dr. William R. Hainsworth, vice-president of Servel, Inc. who has served as president of the A.S.R.E. during the past year.

Other new A.S.R.E. officers who were inducted on December 2 include: Vice-President A. B. Stickney, engineer with Armour & Company, Chicago, Ill.; Vice-President, John F. Stone, manager of the Refrigeration Division, Johns-Manville Corporation, New York, N. Y.; Treasurer, John G. Bergdoll, Jr., chief engineer of the York Ice Machinery Corporation, York, Pa.

Directors elected by the A.S.R.E. to serve for a three-year period are: Charles S. Leopold, consulting engineer, Philadelphia, Pa.; Lee C. Leslie, Johns-Manville Corporation, Philadelphia, Pa.; Nels Rosberg, production manager, California Consumers' Corporation, Los Angeles, Calif.; Arthur B. Schellenberg, president of the Alco Valve Company, St. Louis, Mo.; and J. Mack Tucker, University of Tennessee, Knoxville, Tenn.

Among the Local Sections

Metropolitan Section, Largest in A.S.M.E., Reports on Activities During the Past Year

Program Included 37 Meetings, Educational Courses, Student Guidance, Radio Broadcasts, and Civic Work

METROPOLITAN SECTION, with a membership of 3200 which makes it the largest in The American Society of Mechanical Engineers, completed one of its most active years in June. Due to the size of the group, the activities were sponsored and arranged by standing and special committees under the supervision of an executive committee of nine members. All members of the Section and visitors were invited to attend the monthly meetings of the executive committee held the first Wednesday of each month. Standing committees included Junior Group, Meetings and Program, Admissions, Professional Relations, Student Guidance, Membership, Educational, Professional Licensing, and Student Loan Fund. Among the special committees appointed were those on national defense, radio broadcasts, civic engineering problems, war production, and the annual spring "round-up."

Junior Group

The Junior Group is still quite active although many of its members are serving in the armed forces or engaged in war-production activities. With its own budget and techncial meetings, the group is mainly interested in papers of particular interest to juniors, inspection trips for juniors, and student relations.

The main activities of the section center around the affairs of the Meetings and Program Committee. During the last year 50 technical meetings were planned but, due to the interference of war activities and other affairs, only 37 sessions were actually held. The average attendance at most meetings was between 40 and 75 although some meetings drew over 300, and one drew 512.

Educational Committee

One of the most important activities of the section hinges around its educational program. Each year the Educational Committee offers nine technical courses of instruction. Some of these courses are sponsored solely by the A.S.M.E., others jointly with the local chapters of other engineering societies. These courses are of two types, the first being review courses in engineering to prepare members for examinations required to obtain their licenses as professional engineers, and the second, courses of special interest such as the analysis of stresses and high-pressure piping. Through the tuition fees charged, the section has accumulated a fund which is now being administered by the committee on student loans.

Funds are available through the committee to the sons of members to pay tuition fees and other expenses at college. To date there have been very few applications for loans. However, in less prosperous times it is anticipated that there will be more of a demand for such loans.

The student guidance committee was particularly active during the course of the last year. It held about 40 meetings in the various high schools throughout the metropolitan area. The committee's purpose is to advise prospective college students on engineering courses and tell them some of the duties of the engineer and his place in industry.

Radio Broadcasts

The local chapter of the A.I.E.E. invited the Section to join it in sponsoring a series of radio broadcasts on a nation-wide hookup on various subjects pertaining to engineering. As a result of the work of the joint committee, 18 radio broadcasts were made over the National Broadcasting System on the general topic of "The Engineer at War." Each broadcast was electrically transcribed and records are available to other local sections for the asking.

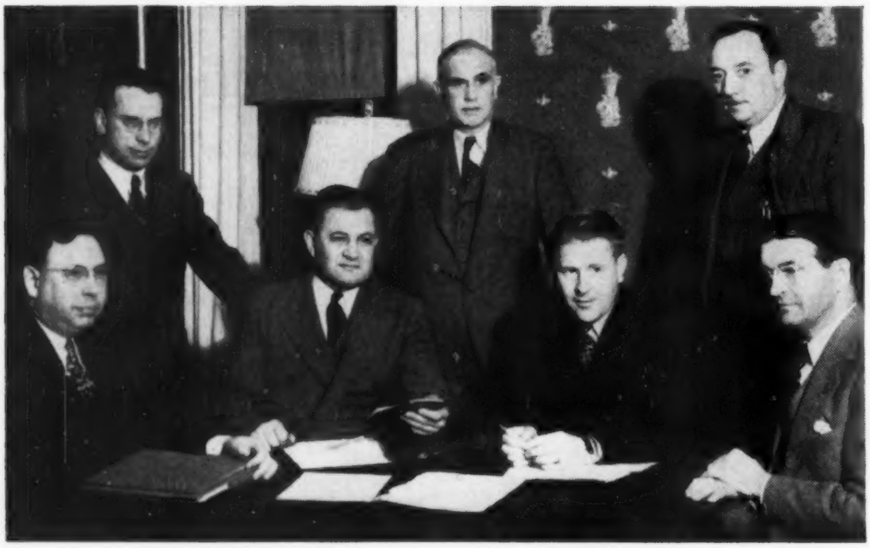
In the spring of 1942 at the request of the War Production Board, the section joined with other engineering bodies in sponsoring a meeting for the discussion of war-production problems. This meeting was attended by more than 1200 engineers and, following the general session, the meeting broke up into a series of small clinics to consider individual problems. As a result a committee has been formd by the section and charged with keeping active the clinics formed at the meeting.

Petroleum Technology Before Akron-Canton Section

MEETING in Canton, Ohio, on the evening of Nov. 19, members and guests of the Akron-Canton Section met to listen to a paper, entitled "New Developments in Petroleum Technology of Interest to Metallurgists and Mechanical Engineers," presented by Dr. C. D. Lowry, Jr., research engineer with the Universal Oil Products Company.

Civic Problems Discussed by Baltimore Engineers and Lawyers

The Baltimore Section met with the members of the Maryland Bar Association on Nov. 23 to discuss a report of the Bond Commission presented by Charles Harkell, counselor at



EXECUTIVE COMMITTEE OF THE A.S.M.E. BUFFALO LOCAL SECTION

(Standing, left to right: W. M. Kaufmann, C. G. Kiplinger, J. L. Yates; seated, from left to right: C. E. Harrington, *treasurer*, N. C. Barnard,, *chairman*, L. R. Burmester, *acting secretary*, Carrol Ross, *vice-chairman*. W. A. Miller, N. S. Snyder, and S. Wagner were not present when the picture was taken.)

law. After the presentation of the report in a clear and nontechnical language, engineers and lawyers discussed the recommendations in regard to the revision of the Court of Appeals, abolition of the Orphans Court, and other important changes in the Maryland judicial system.

Boston Hears About Treatment of Water for Industry

Sheppard T. Powell, consulting engineer of Baltimore, Md., was guest speaker at the Nov. 12 meeting of the Boston Section. Using as his subject, "Treatment of Water for Industry," he discussed such phases as collecting basic data for water supply, treatment of process water, and design and protection for health and against fire.

Parts Interchangeability Subject at Bridgeport

Bridgeport Section in conjunction with the Bridgeport Tool Engineers' Association held a meeting on Nov. 12 in the Burroughs Public Library Auditorium. Louis Lingler, sales engineer with The Sheffield Corporation, spoke on "Accuracy and Interchangeability of Parts," and showed how the success of modern American industry was largely brought about through the introduction of newly developed gages manually or electrically operated, resulting in the control of variations to within tolerances never considered practical in the past.

Engineers Talk at Buffalo About Pipe-Line Problems

With gasoline and fuel-oil rationing a reality, mainly due to transportation problems, members and guests of the Buffalo Section gathered on Dec. 9 to listen to Henry Lehn and V. Gerberaux, consulting engineers, talk on the subject of "Modern Natural-Gas Pipe-Line and Pump Problems on Oil-Pipe-Line Applications." At the Oct. 20 session, J. F. McManus, resident administrator for engineering war-training courses in Buffalo for Cornell University, spoke about "Bombers Over Buffalo, or Technical Aspects of Bombardment Protection." Included in his talk were the principles involved in bombardment, the types of bombs, damage caused, and possible protections.

Paper on Women in Industry Before Central Indiana Section

Dr. Lillian Gilbreth, member A.S.M.E. and professor of management at Purdue University, was the guest speaker before the Central Indiana Section on Nov. 17. Although the weather was bad, more than 50 members, including Dean A. A. Potter and William Hanley, past-presidents of the A.S.M.E., were present to listen to an interesting talk on "Women in Industry."

Chemical Smoke and Camouflage at Chicago

Chicago Section members met on Nov. 9 to hear a talk given by Rene J. Bender on the subject of "Chemical Smoke and Camouflage" and to join in the discussion which followed. After Mr. Bender explained the use of smoke in warfare and how low-cost equipment has been developed for the production of smoke, the objectives, techniques, and results were discussed by Otto K. Jelinek, chief of techniques, O.C.D., of Chicago, F. A. Chambers, director of Chicago smoke department, Dr. A. D. Singh and H. T. Betz, Armour research laboratories, E. Hurwitz, principal sanitary chemist, sanitary district of Chicago, and others.

Cleveland Engineers Learn of Military Developments

"Some Late Engineering Developments for War" was the subject of the Nov. 12 meeting of Cleveland Section. The speaker was A. T. Colwell, vice-president and chief engineer, Thompson Products Co., who gave an illustrated talk on recent airplane developments, both in the United States and abroad.

Conversion From Oil to Coal Discussed Before Columbus

Forty members and guests of Columbus Section were present on Nov. 13 at the Battelle Memorial Institute to hear R. M. Hardgrove, manager of the research and design department, Babcock & Wilcox Co., discuss "Conversion of Oil-Burning Furnaces to Pulverized-Coal Firing." Mr. Hardgrove, who is an authority in the field of heating equipment, pointed out how along the east coast many industries had converted from fuel oil to coal. He showed slides and discussed the changes necessary in a conversion job.

Registration for Engineers Explained to Detroit Juniors

Watts Shelly, executive secretary of the Michigan State Board of Registration for Professional Engineers, talked to the Detroit Junior Group on Nov. 17 on the advantages of registration as a means of achieving professional standing and maintaining it. Following the talk, the speaker answered questions about procedure, examinations, requirements, legal provisions, recognition in other states, and similar matters.

Extensive data on all aspects of conversion from oil to coal firing was presented before the Detroit Section on Nov. 3 by R. M. Hardgrove, manager of the research and design department, Babcock & Wilcox Co. Numerous examples of such changes were described and slides shown to illustrate the changes. Curves showing the effect of oil, stoker, and pulverized-coal firing on different performance factors clearly indicated the advantages of each type of fuel.

East Tennessee Holds Meetings at Knoxville and Chattanooga

Tennessee is such a big place that in order to give every A.S.M.E. member an opportunity to hear Dr. J. T. Rettaliata, Allis-Chalmers Mfg. Co., talk on the development of gas turbines, the executive committee arranged for two meetings, the first on Nov. 17 in Knoxville, and the second the following night in Chattanooga. Needless to say, the members responded in good numbers.

Colonel Tells Erie Members Our Combat Vehicles Best

On Nov. 21, more than 200 members and guests of Erie Section attended the meeting

which featured as its guest speaker, Col. E. L. Cummings, Ordnance Dept., U. S. Army, who outlined the development of our standard combat vehicles and explained their superiority in mobility, armament, and firepower. He illustrated his lecture with motion pictures showing the severe tests made on the vehicles at the proving grounds.

Kansas City Presents Paper on Anthropology

Departing from the usual engineering paper presented at meetings, Kansas City Section on Nov. 20 featured Dr. Logan Clendening and his paper on "The Scientific Achievements of Primitive Man in Central and South Americas." This famous writer and lecturer dealt chiefly with the medical achievements of primitive man in those areas.

President Parker Receives Welcome at Mid-Continent

James W. Parker, president of the A.S.M.E., was the guest of honor at the Nov. 5 meeting of the Mid-Continent Section in Tulsa, Okla. More than 50 engineers attended the dinner and meeting to meet and hear President Parker, who talked about the duties and responsibilities of engineers in national defense and the postwar world.

New Haven Section Has Talk on Patent System

Roy L. Parsell, patent attorney, gave a paper, entitled "Our Patent Mill," before the New Haven Section on Nov. 17. His description of our patent system was followed by slides showing many interesting and some amusing patents.

New Orleans Holds Session on Shell Production

"Shells for the Axis," was the title of the paper presented on Nov. 27 by Werner Henke before the members and guests of New Orleans Section. He told of the manufacture of shells and some features of inspection. Slides of machines used to make shells were shown and different types of shells up to and including 105 mm were on display.

Engineering in the War Effort at Norwich

Norwich Section members met on Nov. 24 and heard a talk on "Engineering in the War Effort," given by Prof. Charles L. Tutt, Jr., Princeton University. Illustrated with slides, the paper showed how existing machinery was converted to war production and new machinery for special purposes designed and constructed. A period of questions and discussion followed of interest to all.

150 Attend Philadelphia Meeting on Locomotives

More than 150 members and guests of the Philadelphia Section gathered on Nov. 24 to see a motion picture, "Remote Control," and hear James Partington talk on the development of steam, electric, and Diesel-electric locomotives and their welding problems.

San Francisco Hunts Bugs in Gear Manufacture

Confined to often overlooked factors and details which are the basis of good gearing, the discussion by San Francisco Section members on Nov. 24 of a paper by G. M. Pamphilon, chief engineer, Johnson Gear and Mfg. Co., on "Bugs in Gear Manufacture," proved very interesting, as well as instructive.

All Phases of Wire Rope Manufacture at St. Louis

J. J. Sieber gave a very interesting paper on "Wire Rope" at the Nov. 27 meeting of the St. Louis Section. The illustrated lecture showed the manufacturing processes, including spooling, stranding, and closing, the many different variations of types and designs, including standard, preformed, right, left, and lang lay, and the many applications in shipbuilding, oil-well drilling, gold mining, logging, and saw mills.

Richmond Session of Virginia Section, Personnel Training

On Nov. 20, a dinner meeting of the Virginia Section, with more than 50 attending, was held in Richmond, Va. The speaker of the evening was Dr. B. H. Van Oot and the subject of his paper was "Emergency Training of Workers and the Effect After the War."

Waterbury Section Advertises Engineering Societies Library

In the meeting notice for the Nov. 16 meeting, Waterbury Section notes at the bottom that each member of the A.S.M.E. has available to him for loan any of the 160,000 volumes at the Engineering Societies Library, 29 W. 39th St., New York, N. Y., for a period of two weeks or more. The meeting itself was addressed by Prof. Charles L. Tutt, Jr., Princeton University, who spoke on "Production Engineering in the War Effort." Amply illustrated, the talk indicated the methods used to convert existing machinery to the war effort.

Shipbuilder Addresses the Members of the Western Massachusetts Section

Despite the fact that ships are twice the size and far more intricate than those made in the last war, they are sliding down the ways twice as fast, stated W. S. Newell, president of the Bath Iron Works, speaking at the Nov. 16 joint meeting of the Western Massachusetts Section and the Engineering Society of Western Massachusetts. He said that his company is employing thousands of workers at its various plants. Particularly was he enthusiastic over the part women were playing in boat construction. He said that his company employed hundreds and found them very satisfactory, steady, earnest, and intelligent., While there is much heavy work the women cannot do, they work at a variety of jobs such as drill presses, turret lathes, milling machines, tack welding, asbestos work, canvas pipe covering.

Western Washington Section Substitutes Ceramics for Metals

Members of Western Washington Section learned a lot on Nov. 24 from their speaker, Dr. Joseph A. Pask, professor of ceramic engineering, University of Washington, who spoke nn the substitution of ceramic materials for critical metals. Following the talk, sound motion pictures from the Bureau of Mines on the manufacture and use of some ceramic materials were shown.

Philadelphia Junior Group Is Host to Swarthmore and Pennsylvania Branches

Meeting Fosters Closer Relations Between Students and Junior Engineers and Helps Membership Growth

MORE than 65 juniors and student members took part in the Nov. 11 joint meeting sponsored by the Philadelphia Junior Group and participated in by the SWARTHMORE BRANCH and the PENNSYLVANIA BRANCH. It was felt that a get-together of this type arising out of the genuine interest on the part of the students and the young engineers of Philadelphia would accomplish much in the way of fostering and maintaining closer relations between the several groups and further the aims and objectives of the A.S.M.E.

William W. Whitmore, chairman of the PENNSYLVANIA BRANCH, opened the meeting with a welcome to the guests and then introduced Barker McCormick, chairman of the SWARTHMORE BRANCH, and William Pegram, who is the chairman of the Junior Group.

The speaker was Lawrence P. Saunders, of the Harrison Radiator Division of General Motors Corp., and a member of a special committee of the N.A.C.A. which is now working on an improved liquid-cooled airplane engine. Using as his subject, "The Development of the Radiator for the Automobile Industry," he explained with the aid of slides how test results are interpreted into useful information in designing and improving radiators and other automotive equipment. Also discussed were cooling fluids, design of fins for cooling equipment, intercoolers, and wind-tunnel tests on cooling of internal-combustion engines.

A discussion followed in which the students as well as the juniors took an equal part.

With the Student Branches

New Award Program for Engineering Students Announced by Lincoln Foundation

THE James F. Lincoln Arc Welding Foundation of Cleveland, Ohio, has announced its first award program in the field of undergraduate engineering study, the $6750 Annual Engineering Undergraduate Award and Scholarship Program. Its object, as expressed in Rules and Conditions governing participation, is "to encourage engineering students to study arc-welded construction so that their imagination, ability, and vision may be given opportunity to extend knowledge of this method and thus aid the war effort and the economic reconstruction in the peace which is to follow."

The Program offers $5000 in student awards and $1750 in scholarships for the departments of the institutions in which the award-winning students are registered.

There are 77 student awards—a first award of $1000, second of $500, third of $250, four awards of $150, eight of $100, twelve of $50, and fifty of $25.

There are seven scholarships of $250 each. The school of the first award winner will receive four scholarships totaling $1000; the school of the second winner will receive two scholarships totaling $500; and the school of the third winner will receive one scholarship of $250.

The winning students will receive an additional honor, since the scholarship in his school will be given his name as: "The John Doe Scholarship of the Lincoln Foundation."

Any resident engineering undergraduate student registered in any school, college, or university in the United States, giving a course in any branch of engineering or architecture, leading to a degree, or any cadet registered in the United States Military Academy, United States Naval Academy, and Coast Guard Academy is eligible to submit a paper in the award program.

The awards will be made for papers describing the conversion from other methods to arc-welded construction of parts of machines, complete machines, trusses, girders, or structural parts. The subject may be something which the student has observed in school shops, magazines, books, printed matter, or elsewhere; or he may conceive of a subject which has never been built but could be built by arc welding. The Foundation encourages the preparation of the type of paper which will not interfere seriously with the student's regular college activities.

It will not be necessary that the machine or structure or part be actually built, but the method of construction or the design must be described in the paper.

A paper may be submitted by any group of students but no one student or group shall participate in the writing of more than one paper. Each student author, or group, must have actually organized and prepared the description, or design, which is presented in the paper.

If the paper covers a project, the project may have been started before December 1, 1942, but it must have been completed within the period December 1, 1942, to April 1, 1943.

The jury of award will be drawn from various branches and institutions of engineering education.

Branch Meetings

Arizona Holds Weekly Meetings

MOTION PICTURES were shown at the Nov. 12 meeting of the ARIZONA BRANCH. The first film, "Target for Tonight," illustrated the planning, preparation, and actual bombing raid on a German city by the Royal Air Force. Other films included "The Power Within," which shows the principle of operation and construction of the gasoline engine, and "Curtiss-Wright Answers the Call for Quantity," which illustrated the construction of a U. S. Army pursuit airplane. A meeting was held the next week, Nov. 18, at which time David Cope, a transfer student from California Institute of Technology, gave an interesting talk on the comparison of the courses and studies at the two schools.

ARKANSAS BRANCH presented two student speakers at the Nov. 9 meeting. John Jacks talked on the different types of communications utilized in the U. S. Army Signal Corps. Robert Tardy gave a paper on the effects of lower-octane gasoline on the design and operation of internal-combustion engines. Speakers at the Nov. 23 session included Ralph Dougherty, John Nelson, and Charles Teal.

BRITISH COLUMBIA BRANCH reports a total membership of 53, an increase of 32 over that of last year. The speakers at the meetings held weekly during the month of October were: Professor W. O. Richmond, "Piping in the Engine Room and Stokehold in the 10,000-Ton Freighter;" Paul Jagger, "The Manufacture of Neon Tubing;" Glen Chestnut, "The Installation of Boilers in the 10,000-Ton Freighter;" and Mike Haddad, "The Manufacture of a Tailplane."

CALIFORNIA TECH BRANCH welcomed James W. Parker, president of the A.S.M.E., on Nov. 3 and heard him give a talk on the subject of "The Position of the Engineer in Industry Today." Hal Hill, a representative of the General Electric Co., talked to the group on Nov. 6, about the one-year test course given by his company to newly employed engineers, and the war research being carried on there.

Catholic U. Visits Smithsonian

The first session of CATHOLIC UNIVERSITY BRANCH was held on Nov. 4 at the Smithsonian Institution. With the war closing all industries to student inspection trips, it was decided to make this affair a review of engineering history and invention. Fred A. Tayler, member A.S.M.E. and curator of the division of engineering at the Institution, conducted the group of 26 students and showed them the historic models and full-size machinery of the past and present in the mechanical and aeronautical field. High lights of the evening were a plastic automobile and an Allison liquid-cooled engine.

WILLIAM B. BURLINGAME AND HIS HIGH-SCHOOL GUEST, JOHN D. JETTE

(Mr. Burlingame of Exeter, N. H., brings a student guest to every Annual Meeting.)

CLARKSON BRANCH held a speaking contest on Nov. 19. George Bliss, talking on "The Use of Silver in Industry," won first prize. Eaton was given second prize for his paper, "Illustrations," and Byer was selected for third prize for talking on "Domestic Rubber Plantations."

DREXEL BRANCH at the Nov. 19 meeting featured Thomas McClarin, Browne and Sharpe, who gave an illustrated talk on "Screw Machines."

IDAHO BRANCH held a meeting Nov. 5 at which Dick Levering and Bill Wicher gave talks about their work this past summer at the Rock Island Dam. This plant is operated by the Puget Sound Power and Light Company. Various engineering problems which these students encountered while there were discussed.

Illinois M.E.'s Beat E.E.'s

The "Buck Knight" trophy, consisting of a thimble symbolizing industry, a collar button signifying the eternal search, and two copper wire handles indicating flexibility and adaptability, is contested for each year at the University of Illinois by the mechanical-engineering and electrical-engineering students. The competition, needless to say, is very keen. The electricals held the trophy for two years, but the mechanicals won the trophy this year on Oct. 7 by a score of 129 to 110 and put it on display in the meeting room of the ILLINOIS BRANCH. At a joint meeting held with the Central Illinois Section of the A.S.M.E. on Nov. 13, members of ILLINOIS BRANCH presented papers. Gus Greanias spoke on the

"Effect of Hot-Quenching on the Toughness of H. S. Steel;" Paul Salerno described "Water-Ejector Pumps," Otto Hintz discussed "Creep Tests of a Phenolic Plastic;" and W. A. Lindahl talked on the "Effect of Range of Stress on the Fatigue Strength of a Phenolic Plastic."

IOWA STATE BRANCH met on Nov. 4 and presented John Shafer, instructor in mechanical engineering, who spoke and showed slides on his experiences as a mining engineer in Latin America. He covered the customs, living habits, and the working abilities of the native people.

KENTUCKY BRANCH exhibited on Nov. 6 two motion pictures which showed the manufacture and operation of M-3 tanks and four-engined bombers. At the Nov. 13 session, Prof. C. S. Crouse, head of the mining-engineering department and secretary-treasurer of the Kentucky State Board of Registration for Engineers, spoke on the subject of licensing and registration of engineers. He stated that all but three states now have laws requiring the licensing and registration of engineers for the protection of the public and the engineering profession.

MARYLAND BRANCH presented as speaker at the Nov. 18 meeting Hugo Sheridan, who spoke on the "History of Aircraft" with special emphasis on warcraft. He discussed the relative superiority of design of American and foreign warcraft.

Michigan Requires Birth Certificates

John Koffel, chairman of the MICHIGAN BRANCH, in calling the meeting of Oct. 28 to order, announced that an inspection trip to the Huron Valley Forge Co. plant had been arranged, but no member could attend without his birth certificate. The chairman then introduced Dr. Abbott, who spoke on "The Profilometer Goes to War."

MICHIGAN STATE BRANCH members heard S. D. Gralak, instructor in mechanical engineering, at the Nov. 17 session. He told of his work with a railroad company on the strain measurements of railroad track, and with a laboratory operating the Berman locator, used for locating bullets or other metal objects within the human body.

MISSISSIPPI STATE BRANCH at the Oct. 29 session showed the motion picture "Keep 'Em Rolling." After the presentation of the film, a short business meeting was held.

Smoker at Nebraska

NEBRASKA BRANCH welcomed its new members at a smoker held on Oct. 30. A movie, entitled "Building a Bomber," was shown. After a series of games, refreshments were served to all.

NEVADA BRANCH reports that the meeting of Oct. 29 was a success as far as attendance was concerned. Present were 26 members and guests. Franklin Peck told of a trip to Berkeley, Calif., to attend a Society meeting, George Voss talked on the advantages of joining the A.S.M.E., and Professor Van Dyke spoke on the work of the Branch and parent unit.

NEW MEXICO STATE BRANCH made plans for the coming year at the Oct. 13 session. Ed Carmichael read a paper on industrial management.

N. Y. U. BRANCH (mechanical division) held a joint smoker with the local chapter of the A.I.E.E. Charles M. Ripley, General Electric Co., spoke on "Electricity and the War," bringing out the interdependence of each branch of the engineering profession on each other. Demonstrated were a few of the electrically made war materials and products.

OHIO STATE BRANCH devoted its meeting of Nov. 13 entirely to business. The meeting was closed with the showing of a motion picture of the high lights of the 1940 football season.

PENN STATE BRANCH held a joint meeting with the A.I.E.E. on Nov. 11. George L. Rishell, Sylvania Electric Products Co., gave an illustrated talk on the manufacture of the modern radio tube.

Purdue Meeting Attracts 200

P. W. Lambell, resident inspector for the British Air Commission at the Allison Division of General Motors Corp., addressed the PURDUE BRANCH Nov. 10 on "The Trend in Aircraft-Engine Design." Following a brief outline of the development of the aircraft engine, Mr. Lambell pointed out several features of modern engine design and the success of these in the various theaters of war. Several possibilities of improvement in the modern engine were suggested, and the advantages of an aircraft Diesel engine and safety fuels were stressed. Possible future developments discussed included multiple crankshafts and fuel-injection units.

R. P. I. BRANCH met jointly with other engineering organizations on the campus on Nov. 19 to hear Charles M. Ripley, General Electric Co. His talk was on "Power for War." He brought a number of exhibits of war-production items, such as an electrically heated flying suit and parts of a turbosupercharger.

RHODE ISLAND BRANCH learned about civilian defense and protection from incendiaries in a talk given by Alton Markham, O.C.D., at the Oct. 29 session.

RICE BRANCH reports that after 23 members turned out for the Nov. 18 session, it had to be canceled since the guest speaker failed to appear. However, on Nov. 4, G. G. Harrington, chief engineer of the Reed Roller Bit Co., told the boys how to sell themselves to their associates in industry.

200 Attend Rose Poly Meeting

More than 200 members and guests were present at the Nov. 4 meeting of the ROSE POLY BRANCH to hear Harry McGowan, Bakelite Corp., give a talk entitled "Modern Plastic Molding Materials." Since not many of the students were familiar with the modern plastic materials, the talk proved to be not only interesting, but also educational.

U.S.C. BRANCH held an organization meeting on Oct. 23. The program for the coming year was discussed, membership campaigns outlined, and the advantages of membership in the A.S.M.E. explained.

SOUTH DAKOTA STATE BRANCH opened the year with a meeting on Nov. 4. Entertainment and programs for coming meetings were discussed and members appointed to various committes by Roger Miller, chairman of the Branch.

SOUTHERN METHODIST BRANCH made the first session of the semester on Nov. 12 an occasion to acquaint potential members with the aims and objectives of the Branch. Entertainment followed and consisted of a quiz show sponsored by "Digby's Steam-Heated Door Knobs,"

AT THE VISIT OF THE TULANE BRANCH TO THE HIGGINS' BOATBUILDING PLANTS NOVEMBER 20

with Prof. C. H. Shumaker acting as Dr. Dig. All present took part.

STANFORD BRANCH held a luncheon meeting on Oct. 31 in honor of the president of the A.S.M.E., James W. Parker, who gave a short talk on the need for industrial engineers in management. Six members of SANTA CLARA BRANCH were guests at the luncheon.

TENNESSEE BRANCH members gathered on Nov. 19 to select from each class the coeds to represent the Branch in the annual contest for the queen of the engineers' ball. Dot Fulghum, Martha Ann Webster, Alice Lee West, and Betty Ann Thompson were the lucky maidens. A picture on "Machining of Aluminum" was presented by Thomas Wright and Charles Cowan.

TORONTO BRANCH welcomed James W. Parker, president of the A.S.M.E., to Canada at a meeting held on Nov. 12. His talk to the members was interesting and instructive. He held the rapt attention of more than 100 students during the address, which was full of facts and good sound advice to young men.

Tulane Visits Higgins' Plants

TULANE BRANCH held a field trip to several of the Higgins' boatbuilding plants on Nov. 20. About 40 members participated. Seen were the construction and outfitting of torpedo boats, landing barges, tugs, and armored craft. Several of the boys when asked to comment on the most interesting part of the trip were unanimous in the opinion that the women war workers were. See photograph on page 91.

VIRGINIA BRANCH started the ball rolling with an opening meeting on Oct. 9. James Borden, chairman, and Professor Hesse, honorary chairman, talked on the purposes and advantages of the A.S.M.E. After outlining the program for the coming year, the meeting was adjourned with the serving of refreshments.

President Parker at Washington

WASHINGTON BRANCH was honored on Oct. 27 by having James W. Parker, president of the A.S.M.E., as the guest speaker. Using as his topic, "How Engineers Serve in a Crisis," he stressed the ever-growing importance of the engineer as part of the educated thinking people of the nation and substantiated his arguments by frequently drawing on his vast stock of experiences in the engineering field.

WASHINGTON STATE BRANCH called a special meeting on Nov. 5 at the request of the senior members, who were interested in knowing what personnel managers of industrial plants look for in graduate engineers. N. J. Akins, of the school's placement service, was selected to give a short, informative paper on the subject. On Oct. 23, more than 75 members and guests of the Branch were present to welcome to the school James W. Parker, president of the A.S.M.E. His talk proved interesting and evoked considerable discussion among the members.

WISCONSIN BRANCH held a joint meeting with the S.A.E. on Oct. 28. Clayborn Von Zandt, assistant chief engineer, Allis-Chalmers Mfg. Corp., spoke and showed slides on the machinery used in cement making. He also spoke briefly about Japan and its people. Refreshments followed.

Engineering College Research Association Is Formed

ACCORDING to *Science*, 73 engineering colleges from all parts of the country have organized an Engineering College Research Association to co-operate with war industry in the prosecution and promotion of research needed for the war effort.

The council of the association, with Dean W. R. Woolrich, of the College of Engineering of the University of Texas, vice-president A.S.M.E., as chairman, held its first meeting in Washington on November 27. The formation of the organization closely follows the establishment by the War Production Board of the Office of Production Research and Development (see MECHANICAL ENGINEERING, December, 1942, page 846) under the direction of Dr. Harvey N. Davis, president of the Stevens Institute of Technology and past-president A.S.M.E. A close degree of liaison between this office and other governmental and private agencies dealing with wartime research will be maintained by the association in an effort to utilize to the fullest possible degree the vast research facilities of the engineering colleges of the nation.

The association will co-ordinate the research activities of the engineering-college laboratories and personnel for the task of conducting vital studies affecting war materials and production. It will also assist in organizing the research facilities of the engineering colleges in undertaking studies designed to promote postwar reconstruction and economic adjustment through new and improved processes affecting industry, public works, the conservation and development of natural resources, public health, and other similar activities. It is further planned that the group will act as a continuing agency for developing and co-ordinating industrial and scientific research and the furtherance of advanced study in the colleges of engineering in the United States. It is pointed out that through the co-operation of such a large number of leading engineering schools expensive and wasteful duplication of effort will be avoided, and that a maximum utilization of facilities and personnel and a high degree of co-ordination will result.

In addition to Dean Woolrich other officers of the association are: Dean Earle B. Norris, member A.S.M.E., Virginia Polytechnic Institute, first vice-president; President C. C. Williams, Lehigh University, second vice-president; Dean R. L. Spencer, member A.S.M.E., University of Delaware, treasurer. Council members of the group are Dean Ivan C. Crawford, University of Michigan; Dean Thorndike Saville, member A.S.M.E., New York University; Dean Samuel B. Morris, Stanford University; Dean F. M. Dawson, the State University of Iowa; Dean N. A. Christensen, Colorado State College, and Dean G. M. Butler, University of Arizona.

This is the first time that the research departments, institutes, and experimental stations of technological institutions have been brought together in an organization of this kind. While most of the members are already associated in other professional and educational groups, they have never joined hands for the express intention of co-ordinating and stimulating engineering research. It brings together in one group institutions with research facilities valued at many million dollars.

A.S.M.E. Local Sections

Coming Meetings

Buffalo. January 11. Hotel Statler. War Production Conference will be held. (Notices will be sent to members at later date.)

Central Indiana. January 8. Indianapolis Athletic Club at 6:30 p.m. Subject: "The Modern Combustion Gas Turbine," by J. T. Rettaliata, assistant engineer, Steam Turbine Department, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Cleveland. January 27. Carter Hotel, Cleveland, Ohio at 2:00 p.m. Joint Meeting in conjunction with Cleveland Technical Societies Council. Subject: "War Production Clinic." This will be a general meeting and panel discussion with several speakers.

Hartford. January 21. Hotel Bond, Hartford, Conn., afternoon and evening, 3:30 to 10:00 p.m. Dinner, 6:15 p.m., Ballroom. War Production Conference, sponsored by War Production and Engineering Council for Northern Connecticut.

Kansas City. January 29. War Production Conference will take place. (Notices to be sent out to membership later.)

Louisville. January 14. Speed Auditorium, University of Louisville at 8:00 p.m. Subject: "Machining with Single-Point Tools," by Max Kronenberg, Cincinnati Milling Machine Co., Cincinnati, Ohio. Also at the same time a showing of "Chips," a sound movie film of the Warner & Swasey Co.

New Haven. January 19. Mason Laboratory, Hillhouse Ave., New Haven, 8:00 p.m. Subject: "Production Problems in the War Industry." Speaker: Charles L. Tutt, Jr., staff assistant to the A.S.M.E. Production Engineering Division.

Ontario. January 14. Hart House, Toronto, Ont., Canada. Combined meeting under the auspices of the Junior Group. Speaker to be announced later.

Philadelphia. January 18. Broadwood Hotel, Philadelphia, Pa., starting at 4:00 p.m. War Production Conference.

Providence. January 5. Engineering Societies Building at 8:00 p.m. Subject: "Fighting Incendiary Fires" (Movie)

St. Louis. January 22. Joint Meeting with S.A.E. Subject: "Influence of Machine Design on Lubrication," by W. G. C. Godron, chief engineer, Socony Vacuum Oil Co., New York, N. Y.

Susquehanna. January 19. Annual Dinner of the Section. (Notices to be sent out to members at later date.)

Virginia. January 25. Patton Hall Auditorium, V.P.I. Campus at 6:45 p.m. Subject: "Lubrication," by George L. Bascome, valuation engineer, State (Va.) Corp. Commission.

(*A.S.M.E. News continued on page 94*)

NO. 1 OF A SERIES

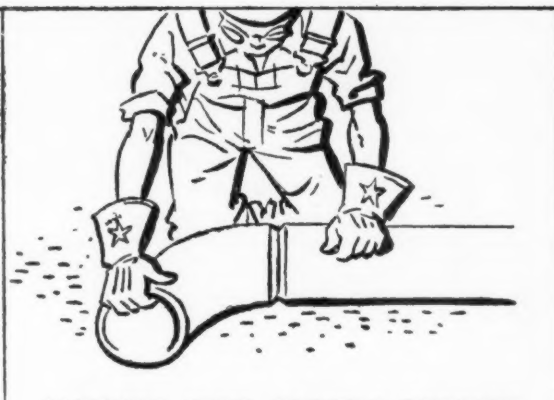
HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

How Tube-Turn welding fittings speed-u[p] piping installation for war production!

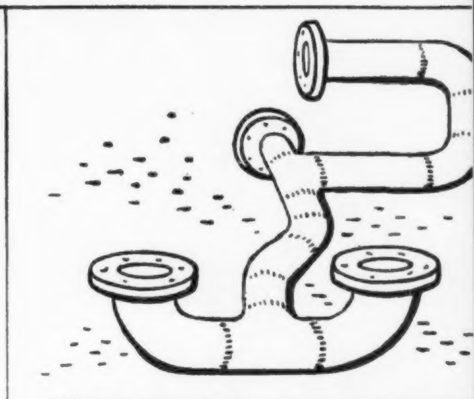
ER, FASTER, SAFER WELDING

rn fittings require only easy circumfer- utt welds—which insure faster, better, safer by both veteran and novice operators.



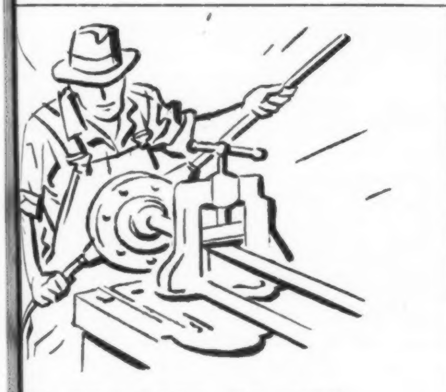
ALIGNING TIME GREATLY REDUCED

Tube-Turn fittings simplify lining-up operations —because their uniform wall thickness and true circularity permit quick alignment with pipe.



WHOLE SECTIONS CAN BE PRE-ASSEM

As Tube-Turn fittings and welded joints strain and save weight, piping sections c welded on the ground to save time, then er

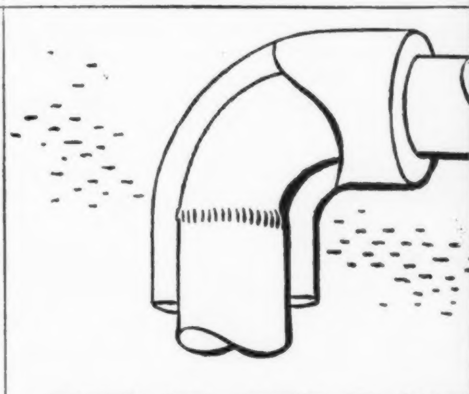


NO THREADS TO CUT

removes the inefficiencies of threaded plus the labor and time applied to thread- be-Turn fittings come ready to install.

NO TORCH CUTTING OR FABRICATION

Since all Tube-Turn fittings are installed with easy-to-make butt welds, they eliminate time-consuming, complicated cutting and fabricating.



FASTER AND EASIER TO INSU

Tube-Turn fittings are insulated as readily pipe, for the welds form one continuous tube. inating many flanged joints shortens covering

FLANGED JOINTS SPEED ERECTION

fittings supplant the need for many of ged joints necessary in screwed piping, aterially reduces over-all erection time.

FEWER HANGERS OR SUPPORTS NEEDED

As welded piping weighs less and stands vibration better than flanged systems, the fewer hangers needed save installation time on these items.

. . And you get stronger, leakp systems that virtually elimin piping maintenance or failu that can slow down or paral vital war industry!

TUBE TURNS
INCORPORATED

Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. *Distributors everywhere.*

UBE-TURN *Welding Fittings*

TRADE MARK

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., which is under the joint management of the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to members and is operated on a co-operative, nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient, nonprofit personnel service and are available upon request. This also applies to registrants whose notices are placed in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York office. A weekly bulletin of engineering positions open is available to members of the co-operating societies at a subscription of $3 per quarter or $10 per annum, payable in advance.

New York	Boston, Mass.	Chicago	Detroit	San Francisco
8 West 40th St.	4 Park St.	211 West Wacker Drive	100 Farnsworth Ave.	57 Post Street

MEN AVAILABLE[1]

MECHANICAL ENGINEER, young, with experience in high-pressure power-plant design, including steel, concrete, piping, and heat-balance calculations; desire chance to increase effectiveness in same line of work. Me-782.

MECHANICAL ENGINEER with 20 years' engineering and production experience as factory manager, assistant factory manager, plant engineer, chief engineer, precision, high production, and heavy metalworking plants; machine, welding shops, foundries. Me-783.

MECHANICAL ENGINEER, graduate New York University, 2 years' graduate study at Polytechnic Institute of Brooklyn. Experience in power plant and gasoline testing. Interested in thermodynamics, management. Me-784.

POSITIONS AVAILABLE

ENGINEERS. (*a*) Mechanical engineer, young, preferably 4 or 5 years out, with some experience in writing, printing, make-up, to write sales brochures and some technical advertising. About $3000 a year. (*b*) Sales engineer, young. Must have several years' experience in South America on sale of machinery, engines, or the like. Will assist company's agents. Will be trained on product from 6 months to year in States. About $4000 year. Locations: (*a*) New Jersey, (*b*) South America. W-1456.

MECHANICAL ENGINEERS AND ELECTRICAL ENGINEERS, 22-50, with experience in general engineering or radio and tube design—electronics. To $5000 year. New York metropolitan area. W-1459.

MECHANICAL ENGINEER for inspection of technical books and magazines for export; preferably conversant with aeronautical field. $3000-$4000 year. N. Y. C. W-1461.

CHIEF ENGINEER. Machine designer with knowledge of hydraulics as applied to machine tools to design completely and develop a hydraulic relay-type governor for Diesel engines. Would do all drafting; should have knowledge of practical shop methods. Little traveling to witness installation of some of first units and correct troubles will be necessary. Permanent. New York. W-1464.

ENGINEER, 35-45, with engineering background and experience in processing industries. Specific experience of particular value would be related to industrial engineering, cost analysis, production planning, packaging specification, and factory layout work. Permanent. $6000-$6500 year. Small amount of traveling. New York, N. Y. W-1469.

GRADUATE MECHANICAL ENGINEER with some training and experience in power-plant work for large textile mill located in South. Should be qualified to make usual power-plant calculations and handle plant-maintenance problems. North Carolina. W-1477.

RAILWAY-SERVICE-MAINTENANCE ENGINEER, 25-35, with B.S. in electrical or mechanical engineering preferred. Should have some experience in either railway mechanics or signal-department work to plan equipment overhauls and supervise overhauling. Some experience on Diesel engines preferable. Draft-exempt. East. W-1480.

ASSISTANT TO GENERAL MANAGER, graduate mechanical engineer, to investigate possibilities of engineering of ore products from research to point of negotiation. Several years' technical and commercial experience. East. W-1482.

ASSISTANT WORKS MANAGER with thorough machine background. Prefer man with experience as assistant works manager. Plant employs about 400 people. Company's products, technical mechanical nature. East. W-1483.

TIME STUDY AND METHODS ENGINEER. Should have some experience in foundry production and be familiar with coremaking, molding, core cleaning, etc. Salary, with overtime, about $5000 year. Northern New Jersey. W-1492.

ASSISTANT TO THE PLANT MANAGER, graduate of recognized school of mechanical engineering preferred. Must have experience in machining of copper or brass. Permanent. $6000-$7000 year. N. Y. C. W-1494.

METHODS ENGINEER able to create designs for fixtures, especially on small assembly operations, purpose being to change present methods to more expeditious production, thus affecting reduction in production costs. New Jersey. W-1506.

ENGINEER, 28-30, to prepare estimates for fabrication of various articles. Must be able to make estimates from drawings and sketches. Man familiar with estimating millwork or machine shop items would qualify. Permanent. About $3000 year to start. Pennsylvania. W-1507.

MECHANICAL ENGINEER to check prime contractors' prints and issue detail change notices. Must understand machine- and assembly-manufacturing operations and some knowledge of stresses would be desirable, as company manufactures aircraft frames. $5000-$5500 year. Middle West. W-1518-CD.

ENGINEERS for company building 5 different types of gun turrets for airplanes, and eventually more. (*a*) Mechanical engineers for processing work in tooling program in shop. Need 37 men. (*b*) Tool designers for the gun-turret work. Need 48 men. Preferably permanent. Salaries, $6500-$7500 year for 54-hour week. Missouri. W-1523-C.

PLANT REPRESENTATIVES, super expediters, who will represent prime contractors and be resident at subcontractor's plant. Must have executive ability and knowledge of machine-shop practice. $3600-$4500 year. Headquarters, New Jersey. W-1525.

MECHANICAL OR ELECTRICAL ENGINEER, graduate, to have charge of all mechanical and electrical-equipment maintenance; 8 to 10 years' actual plant and maintenance experience. $4200-$4800 year. Ohio. W-1531-D.

PRODUCTION ENGINEER for large airplane manufacturing plant. Must have considerable experience with modern production methods in aeronautical industry. Company also needs chief engineer. $4000-$7200 year. Headquarters, New York, N. Y. W-1542.

GRADUATE ELECTRICAL OR MECHANICAL ENGINEER for new product development department. Must have varied engineering background and if possible some design or development experience. Will be required to write and co-ordinate data for engineering reports. Work involves study of new products in commercial and engineering fields. Salary open. Permanent. Pennsylvania. W-1546.

PLANT SUPERVISOR familiar with operation of such machines as press brake, apron brake, squaring shears, electric welders, both arc and resistance types; and knowledge of production methods and practices. Draft-deferred. New York, N. Y. W-1549.

CHIEF ENGINEER, under 50, capable of taking charge of engineering department. Under him will have men in charge of tooling, drafting, processing, rate setting, etc. To $10,000 year. Connecticut. W-1556.

ENGINEERS with some mechanical background or valuation experience, to assist in machinery inventory of large manufacturing plant. $3000-$3500 year, plus overtime. Duration, one year, or possibly permanent. Maryland. W-1571.

MECHANICAL OR ELECTRICAL ENGINEER interested in research, to be director of experiment station connected with state university. Staff and projects include mining, metallurgical, electrical, and mechanical subjects. About $4000 a year. Permanent. West. W-1572.

PERSONNEL ASSISTANT to direct health and safety program in personnel department of

(*A.S.M.E. News continued on page 96*)

[1] All men listed hold some form of A.S.M.E. membership.

large industrial plant. Will be responsible for safety, workmen's compensation, group insurance, absentee control, and supervision of hospital and cafeteria. Must be capable executive able to co-operate with, and co-ordinate work of, department heads. Should know metals-plant safety engineering and have some knowledge of first aid. Company prefers graduate mechanical engineer. Permanent. About $5000 year. Pa. W-1576.

TOOL DESIGNERS. (*a*) Tool engineers to design and develop gages and other measuring instruments. $2800-$3600 year. (*b*) Tool designers for general work on jigs, fixtures, and dies. $2800-$3600 year. Pennsylvania. W-1583-CD.

PERSONNEL DIRECTOR with at least 5 years' experience as personnel executive in machine-tool operations plant. Should be able to institute and co-ordinate training and employment. $6000-$7500 year. Connecticut. W-1587.

PRODUCTION MANAGER with at least 5 years' experience, particularly in automatic machine work. Company also operates small-parts foundry. To $10,000 a year. Permanent. New Jersey. W-1589.

Candidates for Membership and Transfer in the A.S.M.E.

THE application of each of the candidates listed below is to be voted on after January 25, 1943, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

Re = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

NEW APPLICATIONS

For Member, Associate, or Junior

AHRENS, HENRY R., JR., Orange, N. J.
BAER, HERMANN W., New York, N. Y.
BATTLEY, EDWIN R., Montreal, Que., Canada
BEATTY, HENRY R., Millington, N. J.
BENNECHE, CHRISTIAN P., Sullivan, Ind. (Rt & T)
BIRD, BOYAKIN O., Alexandria, Va.
BUDDEN, EDGAR L., Richmond Hill, N. Y.
BURGESS, WILFRID M., Troy, N. Y.
COLLINS, W. I., Wilkinsburg, Pa.
CORBETT, LAWRENCE B., Binghamton, N. Y.
DARCY, BERNARD E., Elmhurst, L. I., N. Y.
DAVIS, JOHN L., Erie, Pa.
DEARDEN, BRIAN B., Bramhall, Cheshire, England
DEJEAN, EDW. A., Montreal, Que., Canada
DEMAREST, RICHARD T., New York, N. Y.
DUNDAS, WM. A., Winnetka, Ill. (Rt)
DURELLI, AUGUST J., Montreal, Que., Can.
DUSENBURY, WM. H., Bogota, N. J. (Rt)
ENGLAND, FREDERIC E., Chicago, Ill.
ENGVALL, H., Trenton, N. J. (Rt)
FANSHIER, C. O. V., Bartlesville, Okla. (Rt)
FOYN, TOR, Rahway, N. J.
FREDERICK, HERBERT S., Newton, Mass.
FROST, DANIEL C., Newark, N. J.
GEBHARDT, CHAS. W., Kent, Ohio
GETHEN, GEO. S., Collingswood, N. J.
GRANEL, JAS. L., Mignon, Pa.
GRETEN, NICHOLAS J., Tottenville, N. Y.
GUBBS, JOS. A., Berwyn, Ill.
HARRISON, MAURICE R., Newark, N. J.
HASSETT, ROBT. J., Middle River, Baltimore Md. (Re)
HENNINGER, FREDK. A., Tulsa, Okla.
HESSION, JOHN WM., JR., Darien, Conn.
HIGGINS, JOHN T., Newark, N. J.
HUTCHINS, A. T., Birmingham, Ala. (Rt)
JAMES, WM. S., South Bend, Ind.
JENKINS, DONALD R., Los Angeles, Calif.
JOYCE, RICHARD E., JR., Meriden, Conn. (Re)
KAISER, HERBERT A., Glendale, L. I., N. Y.
KEEN, ROBERT D., Los Angeles, Calif.
KNAPP, HAROLD O., Elmhurst, L. I., N. Y. (Rt & T)
KOTTCAMP, JOHN P., New York, N. Y. (Rt)
LANGTRY, WILMER D., Chicago, Ill.
LEE, NIXON, Forest Hills, N. Y.
MALLICK, RANDOLPH W., East Pittsburgh, Pa.
MCCAY, WM. T., Houston, Texas
MCCONNELL, RICHARD U., Athens, Ohio
MCLELLAN, J. M., Short Hills, N. J. (Rt)
MINKLER, HAROLD L., Chicago, Ill.
MUNSCHAUER, FREDK. E., JR., Buffalo, N. Y.
NIEMAN, CHAS. H., JR., York, Pa. (Re)
OLIVER, ROBERT C., JR., Dallas, Texas
PARKS, HENRY S., Clearfield, Utah
PAUL, STEPHEN B., Schenectady, N. Y. (Re)
PHARO, C. W., Decatur, Ill. (Rt & T)
PIERCE, THEO. B., Teaneck, N. J.
PLANCK, IVAN A., Ft. Wayne, Ind.
RASMUSSON, W. E., Lansing, Mich.
REILLY, JAS. H., East Orange, N. J. (Rt & T)
REMESCHATIS, RALPH E., New Hyde Park, L. I., N. Y. (Rt)
ROSSMANN, PETER F., Snyder, N. Y.
SANFANANDRE, ALBERT J., Valley Stream, N. Y.
SAXTON, EDMOND F., New York, N. Y.
SCHULTZ, O. BENNETT, Lima, Ohio
SCHURMAN, ISADORE L., Chicago, Ill.
SCHWENDLER, R. H. (CAPTAIN) William Field, Arizona
SHEERAN, LLOYD A. B., Cranston, R. I.
SHORE, JUSTIN O., New York, N. Y.
SKINNER, C. K., Bridgeport, Conn. (Rt & T)
SKLAREVSKY, ALEX. C., Philadelphia, Pa.
SMITH, FRED B., West Orange, N. J. (Rt)
STEHMAN, FREDK. F., Brooklyn, N. Y.
SWEETLAND, ERNEST J., JR., Piedmont, Calif.
THOMPSON, COLLINS, Deepwater, N. J.
TODD, MERYL L., Waterloo, Iowa
TUTTLE, AUBREY S., Hamilton, Ont., Canada
VAN DE POL, HERBERT, Stone Harbor, N. J.
VOGT, AXEL G., Boston, Mass.
WAMBAUGH, RUSSELL H., Washington, D. C.
WESTERMANN, JOHN L., JR., Chicago, Ill.
WICK, ROBERT E., Chicago, Ill.
WILLIAMS, E. E., Upper Montclair, N. J. (Re)
WILLSEA, JASPER, Rochester, N. Y.
WRIGHT, DANIEL K., JR., Shaker Heights, O.
YEOMANS, LUCIEN I., Chicago, Ill. (Rt)

CHANGE OF GRADING

Transfers to Member

BERGER, GEO. G., New York, N. Y.
BUSH, RICHARD T., Charleston, W. Va.
HEITZ, ROBERT L., Chuquicamata, Chile, S. A.
HODGES, KENNETH R., Davenport, Iowa
PRANER, JOS. A., East Orange, N. J.
WHITFORD, ROBERT H., New York, N. Y.

Necrology

THE deaths of the following members have recently been reported to headquarters:

ARMSTRONG, E. P., October 16, 1942
BALLENGER, ROBERT O., September 30, 1942
BAYLIS, ROBERT N., September 5, 1942
BERGEN, HAROLD B., November 4, 1942
BUTTOLPH, BENJAMIN G., October 16, 1942
DE LEEUW, A. L., December 5, 1942
EDMONDS, ROBERT H. G., October 4, 1942
FLETCHER, HAROLD W., October 14, 1942
HAERING, DAVID W., October 30, 1942
HALE, ROBERT S., December 31, 1941
HEALD, GEORGE W., November 16, 1942
HIBBARD, HENRY D., October 17, 1942
HUDSON, ALBERT H., October 29, 1941
KALES, WILLIAM R., December 3, 1942
KEATING, DANIEL A., October 20, 1942
LINDSTROM, NILS O., November 9, 1942
MOORE, LEE C., September 24, 1942
MORHARDT, F. W., November 26, 1942
MORROW, L. W. W., November 16, 1942
NORTON, CHARLES H., October 26, 1942
ROBINSON, EDW. P., May 23, 1942
ROGERS, MRS. NELLIE SCOTT, April, 1942
SKINNER, A. D., December 4, 1942
WARE, WALTER C., October 22, 1942

A.S.M.E. Transactions for December, 1942

THE December, 1942, issue of the Transactions of the A.S.M.E., which is the *Journal of Applied Mechanics*, contains:

Some Two-Dimensional Aspects of the Ejector Problem, by J. A. Goff and C. H. Coogan
Experimental Determination of the Isostatic Lines, by A. J. Durelli
The Photoelastic Analysis of Transverse Bending of Plates in the Standard Transmission Polariscope, by D. C. Drucker
An Analytical Method for Determining the Flexibility of Piping Having Two or More Anchorages, by Harry Miller
Buckling of Rectangular Plates With Built-In Edges, by Samuel Levy
Investigation of Self-Excited Torsional Oscillations and Vibration Damper for Induction-Motor Drives, by A. M. Wahl and E. G. Fischer
Brittle Coatings for Quantitative Strain Measurements, by A. V. de Forest, Greer Ellis, and F. B. Stern, Jr.
Long Continuous Columns, by F. G. Switzer